CAREER & TECHNOLOGY STUDIES

MECHANICS

GUIDE TO STANDARDS AND IMPLEMENTATION

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EDUCATION

CURRICULUM STANDARDS BRANCH

This document was prepared for:

Administrators	✓
Counsellors	✓
General Audience	
Parents	
Students	
Teachers	✓

Program/Level: Career and Technology Studies/Secondary

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NOTE: Shaded areas within this document have been approved for optional implementation. Assessment conditions and criteria are in draft form and will be validated 1994–97.

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CAREER AND TECHNOLOGY STUDIES

PROGRAM PHILOSOPHY/RATIONALE

Through Career and Technology Studies (CTS), secondary education in Alberta is responding to the many challenges of modern society, helping young people develop daily living skills, and nurturing a flexible, well-qualified work force.

In Canada's information society, characterized by rapid change in the social and economic environment, students must be confident in their ability to respond to change and successfully meet the challenges they face in their own personal and work lives. In particular, they must make decisions about what they will do when they finish high school. Many students will enter the work force, others will continue their education. All students face the challenges of growing independence and responsibility, and of entering the highly competitive workplace and/or post-secondary programs.

Secondary schools also face challenges. They must deliver, on a consistent basis, high quality, cost-effective programs that students, parents and community find credible and relevant.

CTS helps schools and students meet these challenges. Schools can respond more efficiently and effectively to student and community needs and expectations by using the opportunities in the CTS curriculum to design courses and access school, community and distance learning resources. Students can develop the confidence they need as they move into adult roles by assuming increased responsibility for their learning; cultivating their individual talents, interests and abilities; and defining and acting on their goals.

As an important component of basic education in Alberta secondary schools, CTS promotes students' achievement by setting clear expectations and recognizing students' success. Students in CTS develop competencies—that is, the knowledge, skills and attitudes students must demonstrate, or what they know and can do.

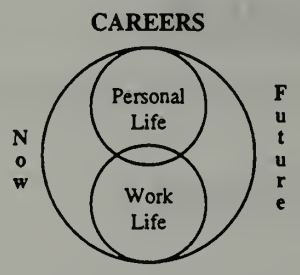
These competencies can be applied now and in the future as students make a smooth transition into adult roles in the family, community, workplace and/or further education. To help ensure this transition for students, clearly stated expectations and standards have been defined with the assistance of teachers, business and industry representatives and post-secondary educators.

CTS offers *all* students important learning opportunities. Regardless of the particular area of study chosen, students in CTS will:

- develop skills that they can apply in their daily lives now and in the future
- refine career-planning skills
- develop technology-related skills
- enhance employability skills

- apply and reinforce learnings developed in other subject areas.

In CTS, students build skills they can apply in their everyday lives. For example, in the CTS program, particularly at the introductory levels, students have the opportunity to improve their ability to make sound consumer decisions, and to appreciate environmental and safety precautions.

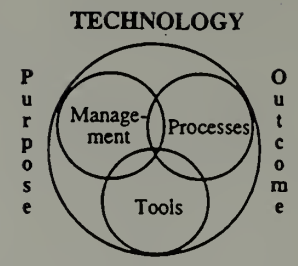


A career encompasses more than activities related to a person's job or occupation; it involves one's personal life in both local and global contexts; e.g., as a family member, a friend, a community volunteer, a citizen.

The integration of careers throughout the CTS program helps students make effective career decisions and target their efforts. Students in CTS will have the opportunity to expand their knowledge about careers, occupations and job opportunities and the education and/or training requirements involved. As well, they will recognize the need for lifelong learning.

Students in CTS will have the opportunity to use and apply technology and systems effectively and efficiently, which involves:

- a decision regarding which processes and procedures best suit the task at hand
- the appropriate selection and skilled use of the tools or resources that are available
- an assessment of and management of the impact the use of the technology may have on themselves, on others and on the environment.



Integrated throughout CTS are employability skills, those basic competencies that help students develop their personal management and social skills. Personal management skills are improved as students take increased responsibility for their learning, design innovative solutions to problems or challenges, and manage resources effectively and efficiently. Students' social skills improve through learning experiences that require them to work effectively with others, demonstrate teamwork and leadership, and maintain high standards in safety and accountability.

Further enhancing the employability skills, CTS reinforces and enhances learnings developed in core and other complementary courses. The curriculum emphasizes, as appropriate, the effective application of communication and numeracy skills.

Finally, in addition to the common outcomes described above, those students who focus on a particular area of study will develop career-specific competencies that support entry into the workplace and/or related post-secondary programs. Career-specific competencies can involve understanding and applying appropriate terminology, processes and technologies related to a specific career, occupation or job.

GENERAL LEARNER EXPECTATIONS

General learner expectations describe the basic competencies that are integrated throughout the CTS program.

Within an applied context that is relevant to personal goals, aptitudes and abilities, the student in Career and Technology Studies will:

- demonstrate the basic knowledge, skills and attitudes necessary for achievement and fulfillment in personal life
- develop an action plan that relates personal interests, abilities and aptitudes to career opportunities and requirements
- use technology effectively, linking and applying available tools, management and processes to produce a desired outcome
- develop personal management skills by:
  - linking theory and practice, using resources, tools, technology and processes responsibly and efficiently (managing learning)
  - applying effective and innovative decision-making and problem-solving strategies in the design, production, marketing and consumption of goods and services (being innovative)
  - selecting relevant, goal-related activities, ranking them in order of importance, allocating necessary time, and preparing and following schedules (managing resources)
- improve social interaction skills by:
  - demonstrating flexibility and cooperative work and communication behaviors (working with others)
  - participating as a team member by working cooperatively with others and contributing to the group with ideas, suggestions and effort (teamwork and leadership)
  - demonstrating high standards of diligence, attendance and punctuality, following safe procedures consistently, and recognizing and eliminating potential hazards (demonstrating responsibility)
- demonstrate appropriate verbal, written, composition, summarization and presentation skills
- use basic computation and measurement principles accurately and efficiently.

PROGRAM ORGANIZATION

CURRICULUM STRUCTURE

Career and Technology Studies is organized into *strands* and *modules.*

Strands in CTS define competencies that help students:

- build daily living skills
- investigate career options
- use technology (managing, processes, tools) effectively and efficiently
- prepare for entry into the workplace and/or related post-secondary programs.

In general, strands relate to selected industry sectors that offer positive occupational opportunities for students. Some occupational opportunities require further education after high school, and some allow direct entry into the workplace. The industry sectors encompass both goods-producing industries, such as agriculture, manufacturing and construction, and service-producing industries, such as business services, health services, and finance and insurance services.

Modules are the building blocks for each strand. They define what a student is expected to know and be able to do (exit-level *competencies*). Modules also specify prerequisites and facility and instructional parameters, where necessary.

The competencies a student must demonstrate to achieve success in a module are defined through the *module learner expectations.* Senior high school students who can demonstrate the module learner expectations (i.e., have the designated competencies) will qualify for one credit towards their high school diploma.

Module learner expectations are a culmination of the *specific learner expectations*, which provide a more detailed framework for instruction. They define the scope and depth of knowledge, skills and attitudes the student should acquire.

The following chart shows the 21 strands that comprise the CTS program and the number of modules available in each strand.

Strand	No. of Modules
1. Agriculture	31
2. Career Transitions	23
3. Communication Technology	32
4. *Community Health*	*25**
5. Construction Technologies	46
6. Cosmetology	58
7. Design Studies	31
8. *Electro-Technologies*	*33**
9. Energy and Mines	27
10. Enterprise and Innovation	8
11. Fabrication Studies	41
12. Fashion Studies	29
13. Financial Management	15
14. Foods	37
15. Forestry	21
16. Information Processing	43
17. Legal Studies	13
18. Management and Marketing	21
19. Mechanics	53
20. Tourism Studies	24
21. Wildlife	17

*Estimate

Note: *As of September 1995, 19 of the 21 strands are available for optional implementation in Alberta junior and high schools. The remaining strands, indicated above in italics, will be phased in from September 1995 to September 1996. Provincial implementation of all strands is scheduled for September 1997.*

LEVELS OF ACHIEVEMENT

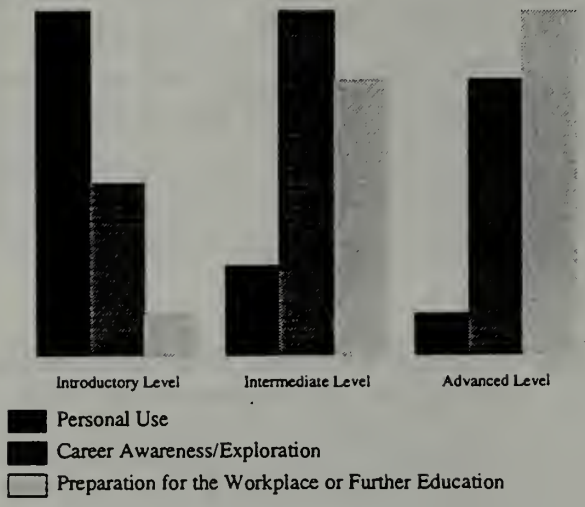
Modules are organized into three levels of achievement: introductory, intermediate and advanced. As students progress through the levels, they will be expected to meet higher standards and demonstrate increased degree of competence, both in the general learner expectations and the module learner expectations.

Introductory level modules help students build daily living skills and form the basis for further learning. Introductory modules are developed for students who have no previous experience in the strand.

Intermediate level modules build on the competencies developed at the introductory level. They provide a broader perspective, helping students recognize the wide range of related career opportunities available within the strand.

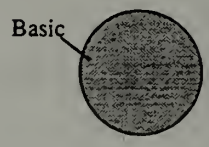
Advanced level modules demand a higher level of expertise and help prepare students for entry into the workplace or a related post-secondary program.

The following illustrates the relative emphasis on the aspects of career planning at each of the levels.



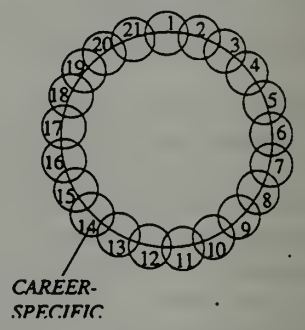
TYPES OF COMPETENCE

Two types of competence are defined within the CTS program: basic and career-specific.



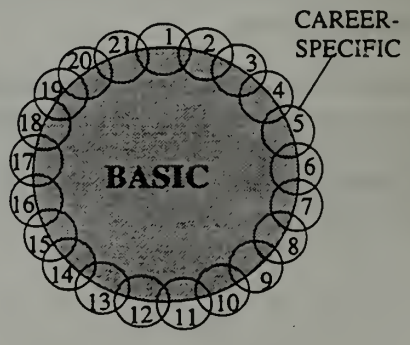
Basic Competencies are generic to any career area and are developed within each module. Basic competencies include:

- personal management; e.g., managing learning, being innovative, ethics, managing resources
- social; e.g., communication, teamwork, leadership and service, and demonstrating responsibility (safety and accountability).



Career-specific Competencies relate to a particular strand. These competencies build daily living skills at the introductory levels and support the smooth transition to the workplace and/or post-secondary programs at the intermediate and advanced levels.

The following model shows the relationship of these two types of competencies within the 21 strands of CTS (numbers refer to the chart on page A.5):



CURRICULUM AND ASSESSMENT STANDARDS

CURRICULUM STANDARDS

Curriculum standards in CTS define what students must know and be able do. Curriculum standards are expressed through general learner expectations for CTS, and through module and specific learner expectations for each strand.

ASSESSMENT STANDARDS

Assessment standards define how the student's performance will be judged. In CTS, each assessment standards defines the conditions and criteria to be used for assessing the competencies defined in each module learner expectation. Students must fully meet each assessment standard, including all of the criteria and conditions defined for the module. Assessment standards are in draft form, as are tools and weightings, and will be validated 1994–97.

Teachers throughout the province will be able to ensure students receive a fair and reliable assessment. Students will use the assessment standards to guide their efforts, ensuring they participate more effectively and successfully in the learning and assessment process. Standards at advanced levels are as much as possible linked to workplace and post-secondary entry-level requirements.

The following pages describe the Mechanics strand in the Career and Technology Studies program.

MECHANICS

STRAND RATIONALE

The movement of people and goods from one place to another has always been important to human existence. Significant advancements have occurred in the development of transportation modes over the last century which have dramatically altered the way we live and make our living. However, the quick and convenient movement of people and goods is not risk free. The ever-increasing use of motor vehicles throughout the world and their reliance on fossil fuels has created major personal safety and environmental concerns. Because the transportation industry is very large and diverse, there are many opportunities for a rewarding career, whether it is to design and build safer and more efficient vehicles or to service the ones that are already in use.

In the Mechanics strand of Career and Technology Studies (CTS), students, through hands-on experiences, have the opportunity to increase their knowledge and skills related to the design and maintenance of transportation vehicles, and the impact they have on the environment and on our economic and social well-being. Whether a student plans to prepare for a work-related role in the industry or wants to simply be an informed owner/operator of a vehicle, the Mechanics strand should be viewed as an educational opportunity for all secondary students.

More specifically, the Mechanics strand will provide students with a broad base of experience and knowledge of systems related to the transportation field, which will enable them to:

- develop the knowledge, skills and attitudes in the context of the school and community to achieve success in personal and work life
- apply effective and responsible decision-making strategies in the design, service and repair of transportation vehicles
- link the knowledge, skills and attitudes developed in other courses in meaningful and practical ways to the field of mechanics
- demonstrate flexibility, cooperative work behaviours and effective communication and leadership skills
- link theory and practice using resources, tools and materials responsibly, safely and efficiently
- develop estimating and reporting skills
- become better informed consumers
- develop technological and manual skills
- exercise safe work and environmental practices

- expand personal knowledge and appreciation of further education and career options and opportunities related to the transportation industry

- determine the economic significance of the transportation industry in the local, national and global community.

STRAND ORGANIZATION

The Mechanics curriculum development model below has been developed around four themes, which relate specifically to the design, operation and care of transportation vehicles. These themes are integrated by a number of common topics, which provide a basic framework for study in each module. The context in which the learning takes place will vary according to the experience and intent of the learner. For example, the student may be interested in vehicle ownership and/or in the preparation for the workplace. As the learner is engaged in the learning activities, specific outcomes are anticipated. These outcomes will take the form of basic, career-specific and personal goals.

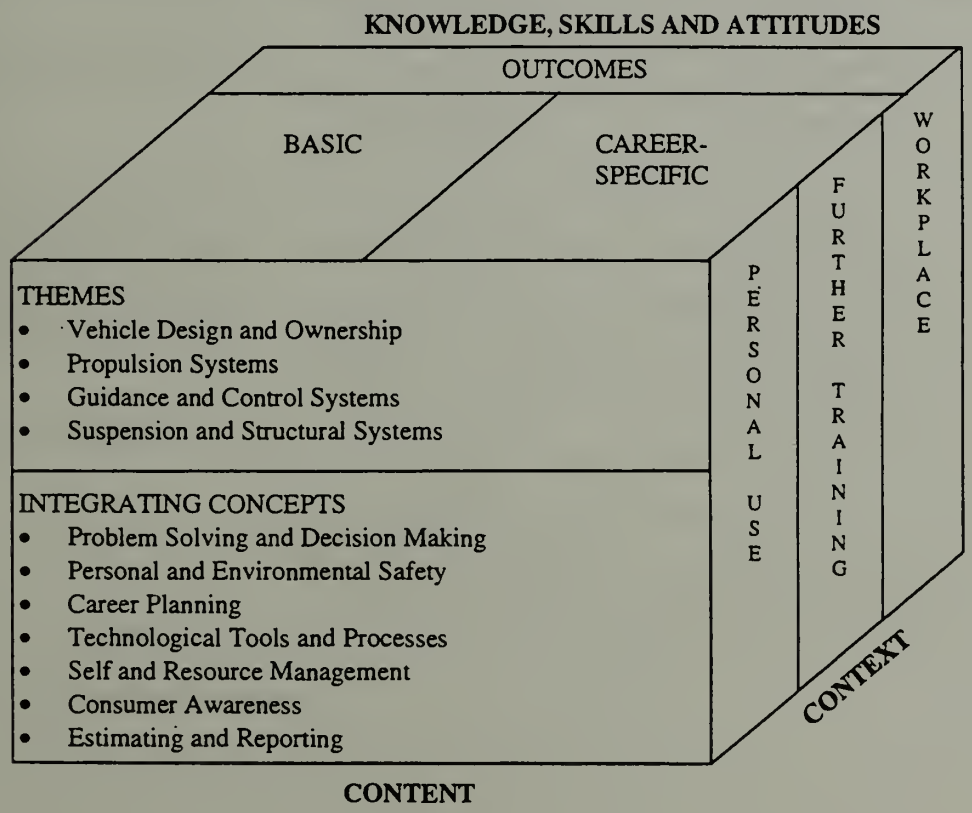
THEMES

Each level of Mechanics has major themes on which modules have been developed:

- vehicle design and ownership
- propulsion systems
- guidance and control systems
- suspension and structural systems
- project and service work.

INTEGRATING CONCEPTS

Integrating concepts, shown on the model, provide a basic framework for the study of each module. The context will vary according to resources available and interest and intent of the student after completing modules in the strand.



SCOPE AND SEQUENCE — MECHANICS

INTRODUCTORY	INTERMEDIATE	ADVANCED	THEME
Modes and Mechanisms	Vehicle Detailing	Buying and Selling a Vehicle	Vehicle Design and Ownership
Vehicle Service and Care	Vehicle Maintenance	Vehicle Value Appraisal	
	Lubrication and Cooling Systems	Engine Performance Diagnosis	Propulsion Systems
Engine Fundamentals	Fuel and Exhaust System	Engine Tune-up	
	Alternate Fuel Engines	Engine Removal and Installation	
	Ignition Systems	Engine Reconditioning I	
	Emission Controls	Engine Reconditioning II	
		Alternate Propulsion Systems	
Electrical Fundamentals	Electrical Components	Computer Management Systems	Guidance and Control Systems
	Power Assist Accessories	Safety Systems	
Pneumatic and Hydraulic Systems	Braking Systems	Climate Control	
	Hydraulic Accessories	Power Assisting	
Mechanical Systems	Power Trains	Automatic Transmissions	
	Manual Transmissions and Transaxles	Power Train Repair	
Ride and Control Systems	Suspension Systems	Wheel Alignment	Suspension and Structural Systems
Vehicle Structures and Materials	Steering Systems	Body Repair Estimation	
Metal Forming and Finishing	Metal Repair and Finishing	Structural Damage Analysis	
	Trim Removal and Installation	Structural Damage Repair I	
Surface Preparation I	Surface Preparation II	Structural Damage Repair II	
	Refinishing I	Refinishing II	
	Basic Touch-up and Finishing	Plastic and Fibreglass	
	Interior Finishes and Repairs	Glass Removal and Installation	

Please check modules for prerequisites/corequisites.

MODULE DESCRIPTIONS

Module MEC101: Modes and Mechanism
Students research, design, build and test a model of a transportation vehicle, using a simple power source, common materials and tools.

Module MEC102: Vehicle Service and Care
Students develop knowledge, skills and attitudes in the care and service of a motor vehicle.

Module MEC104: Engine Fundamentals
Students investigate and describe principles of engines, their construction and applications.

Module MEC109: Electrical Fundamentals
Students focus on the operating principles and applications of electricity.

Module MEC111: Pneumatic and Hydraulic Systems
Students focus on the operating principles and applications of pneumatic and hydraulic systems.

Module MEC113: Mechanical Systems
Students focus on the operating principles and applications of mechanisms that are used to transmit and control mechanical energy.

Module MEC115: Ride and Control Systems
Students develop a basic knowledge of ride and control mechanisms associated with vehicles.

Module MEC116: Vehicle Structures and Materials
Students identify the types of materials and components that are used in a vehicle's construction.

Module MEC117: Metal Forming and Finishing
Students create and form metal panels.

Module MEC119: Surface Preparation I
Students assess the state of a surface and follow restoration procedures.

Module MEC201: Vehicle Detailing
Students develop the skills required to restore and enhance the exterior finishes of a vehicle.

Module MEC202: Vehicle Maintenance
Students execute basic service requirements necessary to ensure the adequate maintenance of a motor vehicle.

Module MEC203: Lubrication and Cooling Systems
Students diagnose, maintain and service the lubrication and cooling systems on a typical four-cycle gasoline engine.

Module MEC204: Fuel and Exhaust Systems
Students diagnose, maintain and service the fuel and exhaust system on a typical four-cycle gasoline engine.

Module MEC205: Alternate Fuel Engines
Students explore the use of alternate fuels used to power motor vehicles.

Module MEC206: Ignition Systems
Students become familiar with the basic components and parts of ignition systems used on internal combustion engines.

Module MEC207: Emission Controls
Students gain an understanding of the importance of controlling emissions and the technology applied to vehicles in order to meet prescribed standards.

Module MEC209: Electrical Components
Students become familiar with the basic use and testing of electrical components used in a typical motor vehicle.

Module MEC210: Power Assist Accessories
Students study and identify the functions and associated parts of power assist accessories.

Module MEC211: Braking Systems
Students develop the necessary knowledge, skills and attitudes to diagnose, service and maintain a braking system according to accepted trade practice.

Module MEC212: Hydraulic Accessories
Students develop a basic knowledge of hydraulic components, applications and servicing techniques.

Module MEC213: Power Trains
Students develop their understanding of the purpose, operation and servicing of a vehicle power train.

Module MEC214: Manual Transmissions and Transaxles
Students perform inspection service and repair procedures on manual transmissions, transaxles and clutch assemblies.

Module MEC215: Suspension Systems
Students develop the knowledge, skills and attitudes needed to service and maintain vehicle suspension systems.

Module MEC216: Steering Systems
Students develop the knowledge, skills and attitudes necessary to maintain a steering system.

Module MEC217: Metal Repair and Finishing
Students repair major sheet metal damage.

Module MEC218: Trim Removal and Installation
Students explore the value, care, removal and repair of trim parts. Emphasis is on removal and installation without damage.

Module MEC219: Surface Preparation II
Students perform advanced surface preparation.

Module MEC220: Refinishing I
Students demonstrate metal surface refinishing procedures.

Module MEC221: Basic Touch-up and Finishing
Students determine and use the appropriate materials, tools and processes to make minor surface repairs.

Module MEC222: Interior Finishes and Repairs
Students research for and use the appropriate products and techniques to maintain vehicle interior surface materials.

Module MEC301: Buying and Selling a Vehicle
Students develop the skills required to make an informed purchase or sale of a vehicle.

Module MEC302: Vehicle Value Appraisal
Students develop an understanding of the use of industry standard references to arrive at an estimation of the cost of mechanical repair and the market value of a vehicle.

Module MEC303: Engine Performance Diagnosis
Students learn to trouble-diagnose an engine for worn/damaged parts and/or improper adjustments.

Module MEC304: Engine Tune-ups
Students diagnose, service and repair engine, fuel, ignition, charging and starting systems.

Module MEC305: Engine Removal and Installation
Students remove and install an engine or a chassis.

Module MEC306: Engine Reconditioning I
Students determine the need for service and perform the required service for the cylinder head and related components.

Module MEC307: Engine Reconditioning II
Students determine the need for service, and perform service on a cylinder block assembly and related components.

Module MEC308: Alternate Propulsion Systems
Students develop an understanding of why vehicle manufacturers continue to build the crank-piston, internal combustion, gasoline engine and also explore some other engine designs.

Module MEC309: Computer Management Systems
Students acquire an overview of the application of computer management systems used in modern vehicles.

Module MEC310: Safety Systems
Students gain an understanding of how safety systems can be tested, diagnosed, replaced or repaired.

Module MEC311: Climate Control
Students expand their knowledge of the purpose, operation and servicing of standard and air conditioning systems.

Module MEC312: Power Assisting
Students further develop their knowledge of the purpose, operation, service and repair of pneumatic, hydraulic and electric power assist devices.

Module MEC313: Automatic Transmissions
Students develop their knowledge of automatic transmissions and transaxles, and their skills in diagnosing and executing some automatic transmission and transaxle repair requirements.

Module MEC314: Power Train Repair
Students perform overhauls on clutch, transmission and differential assemblies.

Module MEC315: Wheel Alignment
Students develop the knowledge, skills and attitudes necessary for the alignment of various steering systems used on vehicles.

Module MEC316: Body Repair Estimation
Students learn the value of detail in the determining cost of repair, and acquire knowledge in estimating.

Module MEC317: Structural Damage Analysis
Students identify and examine physical damage caused by collision, including cost estimating procedures.

Module MEC318: Structural Damage Repair I
Students complete a repair involving removal, replacement and alignment of body parts.

Module MEC319: Structural Damage Repair II
Students examine the methods used to complete a collision repair that involves unibody parts replacement and frame correction.

Module MEC320: Refinishing II
Students demonstrate knowledge and skills of advanced finishing techniques including custom painting, mixing, tinting, colour and texture matching.

Module MEC321: Plastic and Fibreglass
Students determine the type of plastic/fibreglass material and perform the repair procedure.

Module MEC322: Glass Removal and Installation
Students gain knowledge, skill and practice related to vehicle glass installation and adjustment.

PLANNING FOR INSTRUCTION

The Mechanics curriculum framework ensures that students do not repeat content. Schools and teachers have maximum flexibility to design programs based on the needs and interests of their students and circumstances in the school and community. The levels framework will challenge secondary students to keep learning and will provide new and exciting opportunities at each level.

PLANNING FOR CTS

Defining Courses

Schools determine which strands and modules will be offered in a particular school, and will combine modules into courses.

Each module was designed for approximately 25 hours of instruction. However, this time frame is only a guideline to facilitate planning. The CTS curricula are competency based, and the student may take more or less time to gain the designated competencies within each module.

A course will usually consist of modules primarily from the same strand but, where appropriate, may include modules from two or more strands. Refer to the *CTS Manual for Administrators, Counsellors and Teachers* for more information on course names and course codes.

Module selection and sequencing must consider the module parameters, which define:

- prerequisite and corequisites (entry-level competencies)
- instructional qualifications, if specialized. When student are engaging modules that include tasks performed on road-licensed vehicles, tasks such as brakes, steering and suspension require supervision by a journeyman. Students seeking articulation with trade apprenticeship must be taught/supervised by someone with journeyman status.
- equipment and facility requirements, if specialized.

The module parameters are defined for each module, in Sections D, E and F of this Guide

Degree of Flexibility

The CTS program, while designed using the modular structure to facilitate flexible time-tabling and instructional delivery, does not mandate the degree of flexibility a school or teacher will offer. The teacher and school will determine the degree of flexibility available to the student. Within the instructional plan established by the school, the student may:

- be given the opportunity to progress at a rate that is personally challenging
- have increased opportunity to select modules that develop competencies he or she finds most relevant.

Integrating Basic Competencies

Basic competencies are integrated throughout the CTS program and within each module. Selected basic competencies will be emphasized within a module, depending on the nature of the career-specific competencies defined for the module.

Refer to Section G (Assessment Tools) of this Guide for the description of student behaviours expected to meet basic competencies.

Assessment of basic competencies could include input and reflection from the student, teacher, peers and workplace supervisors. Description of the observed behaviour could be provided through a competency profile for the module. Positive, ongoing interaction between the student and teacher will support motivation for student growth and improvement.

The basic competencies related to safety, service teamwork and accountability should be emphasized in Mechanics modules, particularly at the advanced level where industry-based activities and projects would be appropriate.

Although no mark would be assigned to the student's performance in the designated basic competencies, a description of the level of performance should be included within the assessment of each module.

Assessing Student Achievement

Assessing the student's competency is a process of gathering information by way of observations of process, product and student interaction.

Where appropriate, assessment tools have been defined to assist the teacher and student in the assessment. Refer to Section G (Assessment Tools) of this Guide for copies of the various tools (worksheets, checklists, sample questions, etc.).

The relative weighting, or emphasis, for each assessment standard has also been established. The weighting is a guideline to help teachers determine a percentage grade for students.

Recognizing Student Achievement

At the high school level, successful demonstration of the exit-level competencies in a module qualifies the student for one credit. Refer to Section A of this Guide for more detailed information about how curriculum and assessment standards are defined in CTS. Refer to the *CTS Manual for Administrators, Counsellors and Teachers* for more information on how student achievement can be recognized and reported at the school and provincial levels.

Resources

A comprehensive resource base, including print, software and audio-visual has been identified to support the Mechanics strand. It is intended that these resources will form the basis of a resource centre, encouraging teachers and students to access a wide selection of resources and other information sources throughout the learning process. Unless otherwise noted, these resources are considered to be suitable for both junior and senior high school students.

Authorized resources may be obtained from the Learning Resources Distributing Centre or directly from the publisher or distributor. Refer to the Learning Resources section of this Guide for the complete resource list including curriculum correlations and resource annotations. Additional sources refer to non-commercial or government agencies that offer resources that may be of assistance in this strand.

In addition to the resources, sample Student Learning Guides are available. These samples, designed for individual student or small group use, provide an instructional plan for selected modules and include the following components:

- Why take this module?
- What are the entry-level competencies?
- What are the exit-level competencies?
- What resources may be accessed?
- What assignments/activities must be completed?
- What are the timelines?
- How will the final mark be calculated?

Sample Student Learning Guides have been developed for the following modules in Mechanics:

- Modes and Mechanism
- Vehicle Care
- Vehicle Detailing.

Copies of these sample learning guides can be obtained, by request, from the CTS Unit in print and/or disk format (Microsoft Word).

PLANNING FOR MECHANICS

The following suggestions are provided to assist teachers and school and school system administrators as they plan to deliver modules from the Mechanics strand.

Selecting Modules

The scope and sequence chart on page B.5 provides an overview of the Mechanics modules, indicating theme areas. Brief descriptions of the modules are on pages B.6 to B.8.

Course planning should take into consideration module sequences that link with both physical and human resources present in the school and community.

Mechanics for Junior High School Students

The introductory level modules may be offered in part on in whole at the junior high level. As available resources in each school and community will vary, it is important to assess potential support networks prior to selecting module sequences.

The number of modules will vary according to the time available throughout Grades 7, 8 and 9:

Time Available	Modules
8 – 25 hours	**Modes and Mechanisms**
50 hours	**Mechanical Systems** **Engine Fundamentals**
75 – 100 hours	*add one or two of the following:* **Vehicle Service and Care** **Electrical Fundamentals** **Vehicle Structures and Materials** **Metal Forming and Finishing**

Where appropriate, junior high school students may also take intermediate level modules, particularly in the Vehicle Design and Ownership theme.

Modules may be combined into courses and offered within a school year or over a span of a few years.

Mechanics for Senior High School Students

Following are a few examples of module groupings into sample courses:

3 credits (no previous strand experience) with a focus on vehicle ownership	**Vehicle Service and Care** **Vehicle Detailing** **Vehicle Maintenance** **Buying and Selling a Vehicle** **Vehicle Value Appraisal**
3 credits (strong background from junior high school) with a focus on the automobile	**Electrical Fundamentals** **Ride and Control Systems** **Vehicle Structures and Materials** **Vehicle Maintenance**
5 - 10 credits (foundation for workplace/post-secondary entry in technical/ support positions involving motor vehicles	**Lubrication and Cooling System** **Fuel and Exhaust Systems** **Ignition Systems** **Electrical Components** **Braking Systems** **Power Trains** **Manual Transmissions** **Suspension Systems** **Steering Systems** **Engine Performance Diagnosis**
5 - 10 credits (foundation for entry into post-secondary programs in Autobody)	**Metal Forming and Finishing** **Surface Preparation I** **Metal Repair and Finishing** **Surface Preparation II** **Refinishing I** **Basic Touch-up and Finishing** **Body Repair Estimation** **Structural Damage Analysis** **Structure Damage Repair I** **Structure Damage Repair II** **Refinishing II**

Modules could also be grouped into comprehensive courses that develop competencies relevant to career paths within a specific industry.

Organizing for Learning

A "learn by doing" approach is recommended for the Mechanics strand. Essentially, the teacher's role will become that of guide and partner in the learning process. The "learn by doing" approach requires the teacher to be facilitator and coach, rather than subject-based expert, as students

actively participate in learning by doing and discovering.

Small group instruction is a good way to foster learning by doing and discovering. Small groups enable students to be active participants in learning, and develop independent and responsible learning habits. As students work in small group situations they will share information, solve problems, develop consensus, and help each other learn content and processes.

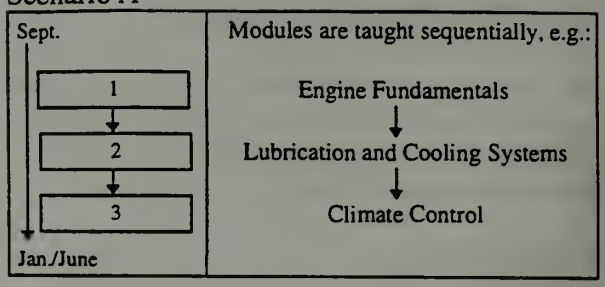
The community is a major stakeholder in education and can be an effective partner in the learning process. The use of community members and resources should be integrated into course planning. Business, industry and government agencies offer a wide range of services and resources, as do local clubs, service groups and institutions. When planning for the use of community resources, teachers should ensure that related presentations and/or activities:

- are consistent with student knowledge and skill levels
- demonstrate sound pedagogy
- are exemplary of approved health and safety standards
- provide a balanced approach to curriculum topics and related issues.

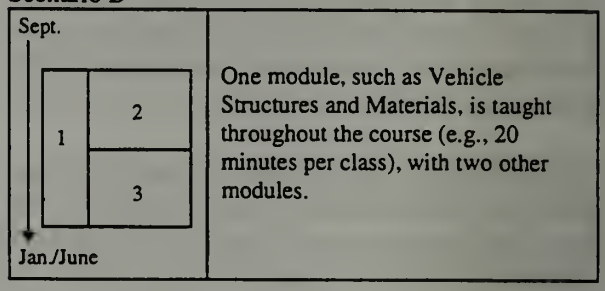
Prior to selecting modules, teachers should check the module parameters outlined in each module (see Sections D, E and F of this Guide). These module parameters, in addition to identifying prerequisite or corequisite modules, assist in identifying community partners and resources when required.

Modules can be delivered sequentially, concurrently or combined. For example, if an instructional block of safety is desired, the safety aspects of several modules could be combined.

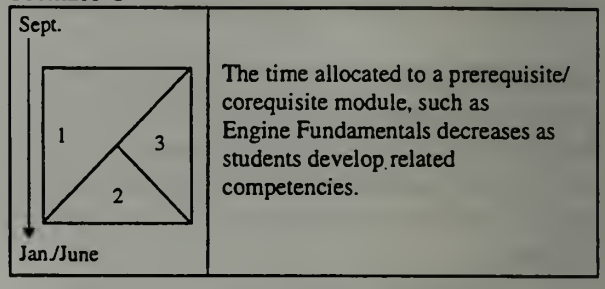
Scenario A



Scenario B

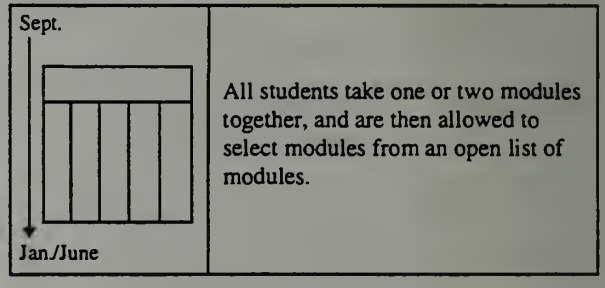

Sept.
1
2
3
Jan./June
One module, such as Vehicle Structures and Materials, is taught throughout the course (e.g., 20 minutes per class), with two other modules.

Scenario C

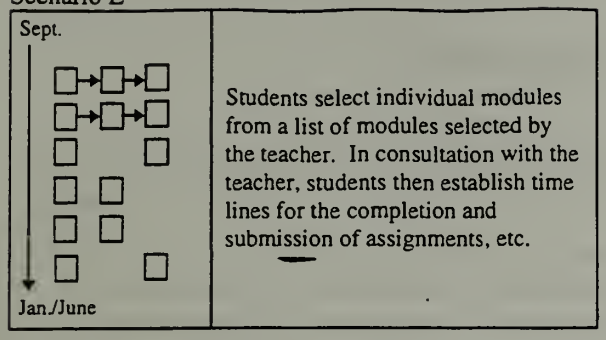


Teachers can also allow students to progress at a rate that is personally challenging.

Scenario D


Sept.
Jan./June
All students take one or two modules together, and are then allowed to select modules from an open list of modules.

Scenario E


Sept.
Jan./June
Students select individual modules from a list of modules selected by the teacher. In consultation with the teacher, students then establish time lines for the completion and submission of assignments, etc.

Plans for instruction must address social, economic and environmental perspectives related to resource development. Provide opportunities for students to become involved in learning experiences that reflect a broad understanding of related issues and alternatives. Presentations of course content that reflect a singular or narrow view of mechanics are not consistent with learner expectations and must be avoided.

As in all CTS strands, students will identify, explore and prepare for future career opportunities. It is recommended that course planning include the integration of relevant career investigations throughout each module, rather than as a singular or isolated study. Career profiles, interviews and job shadowing will acquaint students with the many technical and professional careers associated with the Mechanics field.

Addressing Safety in Off-campus Excursions

Field excursions are recommended and should be an important part of teaching and learning throughout the Mechanics strand. Safety must be a prime consideration in planning off-campus learning experiences. Both teachers and students should engage in activities commensurate with their level of training and ability. Adequate instructional support, guidance and supervision must be provided at all times. Local jurisdiction and school policies must be understood and observed by principals, teachers, parents, supervisors and students.

Preparation and Risk Anticipation

The preparation stage is the most important part of any off-campus excursion. At this stage of planning, potential risks can be anticipated and either avoided or moderated. The preparation stage should focus attention on:

- trip administration, including the use of parental permission forms, health information forms, school/system authorization forms and accident report forms
- a review of laws and regulations relevant to the excursion and activities that will be undertaken
- study of the site to which the trip is being conducted, and the identification of potential hazards and risks
- determination of group size and the level of supervision that will be required (i.e., supervisor/student ratio)
- a briefing of parents, school administrators, government/industry authorities or others who should be informed in the event of an accident regarding itineraries, participants and emergency response plans
- pre-trip logistics, including transportation, equipment, facility and departure date considerations
- student preparation, including background knowledge and experience, medical problems and/or needs, mental and physical preparedness, and training in specific skill areas.

On-site Risk Management

Safety and risk management involves exercising situation-specific judgement throughout the course of an off-campus excursion. Judgement is the product of experience, and may include recognizing factors such as dangers imposed by equipment, a decline in physical strength, or a more challenging task. Many of the hazard recognition skills can be taught in the classroom in the preparation stage.

A significant aspect of on-site risk management is group management. Teachers can exercise appropriate group management strategies by focusing attention on:

- pacing and observation distance, including speed of travel, rest stops, distance travelled and maintaining safe distance for observations
- group control, including position of leader, regrouping procedures, signal systems and buddy systems
- the establishment of group rules and norms
- clearly defined task allocations for each student
- objective hazard recognition on the site, including machinery and equipment.

Identifying Linkages

Section H of this Guide describes linkages within CTS strands.

Note that project modules from the Career Transitions strand may be combined with modules from Mechanics to provide increased opportunity for students to develop expertise and refine their competencies. Project modules are **not** designed to be offered as distinct courses and should **not** be used to extend Work Experience 15, 25 and 35 courses.

Improving Smooth Transitions to the Workplace and/or Post-secondary Programs

Refer to Section H of this Guide for potential transitions students may make into:

- the workplace
- related post-secondary programs or other avenues for further learning.

MODULE CURRICULUM AND ASSESSMENT STANDARDS:

INTRODUCTORY LEVEL

The following pages define the curriculum and assessment standards for the introductory level of Mechanics.

Introductory level modules help students build daily living skills and form the basis for further learning. Introductory modules are developed for students who have no previous experience in the strand.

Module learner expectations define the competencies a student must demonstrate to achieve success in a module. Assessment standards define the conditions and criteria to be used for assessing the competencies defined in the module learner expectations. These assessment standards and the accompanying assessment tools are in draft form and will be validated from 1994 to 1996.

Specific learner expectations provide a detailed framework for instruction to help students build the competencies defined in the module learner expectations. Additional information and suggestions for instruction are provided in the Notes column; teachers may wish to use this space to record their ideas for instruction or student projects.

Module MEC101:	Modes and Mechanisms	D.3
Module MEC102:	Vehicle Service and Care	D.7
Module MEC104:	Engine Fundamentals	D.13
Module MEC109:	Electrical Fundamentals	D.17
Module MEC111:	Pneumatic and Hydraulic Systems	D.21
Module MEC113:	Mechanical Systems	D.25
Module MEC115:	Ride and Control Systems	D.29
Module MEC116:	Vehicle Structures and Materials	D.33
Module MEC117:	Metal Forming and Finishing	D.37
Module MEC119:	Surface Preparation I	D.41

MODULE MEC101: MODES AND MECHANISMS

Level: **Introductory**

Theme: **Vehicle Design**

Prerequisite: **None**

Module Parameters: **Access to basic hand tools**

Students research, design, build and test a model of a transportation vehicle, using a simple power source, common materials and tools.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• demonstrate the safe use of tools and follow established lab procedures	• observed performance related to: – following established shop/lab routines – maintaining a tidy workplace – selecting and safely using tools. *Assessment Tool* *Safety–Care Checklist, MEC SAF 1* *Standard* *Performance rating of 2 on each criteria*	15
• list and describe the systems that are common to all modes of transportation	• listing and describing systems common to all modes of transportation. *Assessment Tool* *Report Assessment Form, MEC REP 1* *Standard* *Performance rating of 2 on each criteria*	30
• research, design, build and test a concept vehicle	• observed performance relative to: – research skills – designed product – built product. *Assessment Tool* *Introductory Project, MEC IPJ 3* *Standard* *Performance rating of 2 on each criteria*	55

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will: • demonstrate effort to develop basic competencies.	*Assessment of student assessment will be based on:* • observations of individual effort and interpersonal exploration during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Safety and Environmental Concerns	*The student should:* • follow safety rules and guidelines related to the use of basic hand and power tools • recognize the hazards associated with the use of: – compressed gases – liquids under pressure – flammable materials – components under tension.	
Transportation Modes	• identify a transportation mode that can be used to move passengers or goods in a: – terrestrial – marine – atmospheric – space environment • determine, in a given environment, what forces must be overcome to start and keep a vehicle/craft in motion • list and describe the function of the following systems: – propulsion – guidance – control – suspension – structural – solar and wind – alternative sources.	

MODULE MEC101: MODES AND MECHANISMS (continued)

Concept	Specific Learner Expectations	Notes
Vehicle Systems	*The student should:*	
• Propulsion	describe and demonstrate how energy is used to produce motion using: – gravity – elastic or spring materials under tension – compressed gases – liquids under pressure – electromagnets – combustion	
• Guidance and Control	• identify and compare the guidance and control mechanisms that are used in connection with a: – land vehicle – marine craft – air craft – space craft	
• Ride/Suspension	• identify and compare the means by which a vehicle or craft is supported: – on land – in air, water or space	
• Structural	• identify the types of structures and materials that are used to support vehicular systems and provide maximum safety and performance.	
Application	• research, design and construct a vehicle or craft for a predetermined use.	Follow design process. Projects depend on the selection of transportation mode and propulsion system. Project examples are: • CO_2 powered craft/ vehicle • solar powered • rubber band powered • battery powered • bottle sockets.

MODULE MEC101: MODES AND MECHANISMS (continued)

Concept	Specific Learner Expectations	Notes
Testing/Evaluation	*The student should:* • identify an appropriate measurement technique to assess applicable factors such as: – speed – pulling power – payload – efficiency • describe operation and construction of the transportation vehicle.	Suggest self-evaluation.
Portfolio Development	• keep notes, sketches, work drawings, pictures and performance records.	

MODULE MEC102: VEHICLE SERVICE AND CARE

Level: **Introductory**

Theme: **Vehicle Design and Ownership**

Prerequisite: **None**

Module Parameters: **Access to commercially available products and related resources**

Instructional Qualification: **Client work must be checked by qualified technician**

Students develop knowledge, skills and attitudes in the care and service of a motor vehicle.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• demonstrate safe use of tools and established lab procedures	• observed performance related to: – following established shop lab procedures – proper handling of vehicle fluids – safe handling of vehicle cosmetic products – maintaining a tidy workplace. *Assessment Tool* *Safety–Care Checklist, MEC SAF 1* *Standard* *Performance rating of 2 on each criteria*	10
• develop a service schedule for a vehicle as a means of preventive maintenance	• developed service schedule for a given vehicle considering the following: – items to be checked – items to be replaced – distance/time intervals – conditions. *Assessment Tool* *Report Assessment Form, MEC REP 2* *Standard* *Performance rating of 2 on each criteria*	20

MODULE MEC102: VEHICLE SERVICE AND CARE (continued)

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• inspect and service a vehicle as outlined in the vehicle service schedule	• observed performance in: – completion of schedule – selection and use of service materials – time on task – see the value in the task. *Assessment Tool* *Task Assessment Checklist, MEC TSK 4* *Standard* *Performance rating of 2 on each criteria*	45
• clean and apply a protective coating to the exterior and interior surfaces of a vehicle in preparation for use or storage	• observed performance in cleaning and applying protective coatings to a given vehicle, observing the following: – proper selection and use of equipment/materials – thoroughness of completed task – ability to problem solve – time on task. *Assessment Tools* *Task Assessment Checklist, MEC TSK 4* *Standard* *Performance rating of 2 on each criteria*	25
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal exploration during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Safety and Environmental Concerns	*The student should:* • follow practices that promote safety and protect the environment.	
Consumer Service	• write up a repair order.	Emphasize legal aspects.
Rationale of Vehicle Service and Care	• explain why preventive maintenance can: – avoid expensive repairs – improve reliability and safety – improve efficiency – extend the life of the vehicle.	
Vehicle Components and Systems	• identify and locate a vehicle's major mechanical and structural components that need regular service and care.	
Tools and Equipment	• identify and safely use common mechanics hand tools and equipment.	
Routine Vehicle Inspection	• complete a visual inspection of: – fluid levels – hose and belt condition – tire pressure and condition – lights and accessories – battery condition – other.	Routine battery service.
Service Schedules and Records	• prepare a service schedule using the owner's manual or a shop manual to determine when to: – change lubrication fluids – replace filters – drain and replace coolants – lubricate body components – inspect and lubricate suspension and steering joints – inspect brake linings – repack bearings – rotate tires – other.	Should meet local conditions.

Concept	Specific Learner Expectations	Notes
Replacement Parts and Products	*The student should:* • determine from the owner's manual the recommended: – type and grade of motor oil – type of engine coolant – brake fluid – power steering fluid – transmission fluid – type of air, oil and fuel filters.	
Vehicle Repairs	• determine what type of maintenance can be safely done by students • list characteristics of an appropriate service centre and technician.	
Vehicle Servicing	• demonstrate the procedure used to: – replace engine motor oil, coolant and filters – lubricate chassis and body parts – clean and check the battery condition – rotate tires – check tire pressure – dispose of used fluids and parts – other.	
Vehicle Operation	• identify potential trouble signs such as: – warning lights or gauges – unusual odours or noises – fumes – leaks – other.	
Cosmetic Care	• identify and demonstrate the use of products that can be safely used to: – clean a painted surface – degrease components – wax and polish a surface – other; e.g., chip protection.	For example, head lamp covers, nose guards, mud flaps, side protection moldings.

Concept	Specific Learner Expectations	Notes
Vehicle Storage and Shelter	*The student should:* • describe what steps should be taken when a vehicle is stored for a period of time • explain why it is necessary to shelter or protect a vehicle from: – the sun's radiation – salt – heat and cold – other.	
Emergency Roadside Service	• list items to be taken on trips (winter, summer) • tire change procedure • boost (jump-start) a vehicle • perform basic troubleshooting on a stalled vehicle.	Follow recommended procedure to avoid damage to vehicle or battery explosion.

MODULE MEC104: ENGINE FUNDAMENTALS

Level: **Introductory**

Theme: **Propulsion Systems**

Prerequisite: **None**

Module Parameters: **Access to engine measuring tool, related resources, engine samples**

Students investigate and describe principles of engines, their construction and applications.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• demonstrate the safe use of tools and follow established lab procedures	• ability to: – follow established lab procedures – selection proper and safe use of tools – understand hazards of gasoline. *Assessment Tool* *Safety–Care Checklist, MEC SAF 1* *Standard* *Performance rating of 2 on each criteria*	15
• compare the operating principles of engine types	• a report comparing the operating principle of the following engine types: – two-stroke cycle – four-stroke cycle. *Assessment Tool* *Report Assessment Form, MEC REP 1* *Standard* *Performance rating of 2 on each criteria*	20

MODULE MEC104: ENGINE FUNDAMENTALS (continued)

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• determine the condition of an engine	• problem solving the condition of a given engine, demonstrating the following: – determining compression pressures – spark plug voltages – fuel supply – spark timing – use of resources – mechanical condition/engine measurements for bore, stroke and displacement. *Assessment Tool* *Problem-solving Assessment Tool, MEC PRO 5* *Task Assessment Checklist, No. 4* *Standard* *Performance rating of 2 on each criteria*	55
• describe the by-products of combustion and their impact on the environment	• listing/describing of combustion by-products and their impact on the environment, including the following: – carbon dioxide – carbon monoxide – oxides of nitrogen – particulates. *Assessment Tool* *Report Assessment Form, MEC REP 2* *Standard* *Performance rating of 2 on each criteria*	15
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal exploration during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and assessment tools noted above*	Integrated throughout

MODULE MEC104: ENGINE FUNDAMENTALS (continued)

Concept	Specific Learner Expectations	Notes
Safety and Environmental Concerns	*The student should:* • follow lab safety procedures.	
Measurement and Fasteners	• identify and use measuring tools in both imperial and metric, such as: – steel rule – calipers and dividers – micrometer – dial indicator – torque wrench – pressure gauges – other. • identify and use fasteners associated with engines (measurements in both imperial and metric), such as: – bolts, studs and nuts – washers – pins – keys – snap rings – machine screws – other.	
Conversion of Heat to Motion	• describe the effects of heating a gas in an enclosed space • identify the types of fuels commonly used in combustion engines • describe the by-products of combustion and their effects on health and the environment.	
Engine Types	• determine the difference between an internal and an external combustion engine • identify the type of engines and fuels that are used for air, land, sea and space applications.	

Concept	Specific Learner Expectations	Notes
Reciprocating Engines	*The student should:* • recognize and label the major parts of a reciprocating engine • demonstrate how reciprocating motion is converted to rotary motion • examine and explain the difference between a two- and a four-stroke cycle engine.	
Engine Systems	• explain the purpose of the following support systems: – cooling – lubrication – ignition – fuel – exhaust.	Purpose only.
Engine Description	• demonstrate how engines differ according to their: – number of cylinders – design – size – make and model – other • apply the data to locate: – service bulletins and repair manuals – engine specifications – parts numbers and assembly procedures.	
Engine Service	• describe the hazards associated with: – gasoline and other flammable liquids – exhaust gases – hot coolants • determine the condition of an engine.	

MODULE MEC109: ELECTRICAL FUNDAMENTALS

Level: **Introductory**

Theme: **Guidance and Control Systems**

Prerequisite: **None**

Module Parameters: **Access to multimeter, battery hydrometer, battery charger, related battery tools, electrical supplies**

Students focus on the operating principles and applications of electricity.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• demonstrate safe use of tools and follow established lab procedures	• observed performance related to: – following established lab/shop procedures related to: • storage battery handling/service • use of electrical meters • personal protective equipment • working with others. *Assessment Tool* *Safety–Care Checklist, MEC SAF 1* *Standard* *Performance rating of 2 on each criteria*	25
• describe and apply the electrical principles and concepts	• recognition of series and parallel circuits on a vehicle and ability to measure voltages, resistances and current flow in lighting, charging and starting systems. *Assessment Tool* *Task Assessment Checklist, MEC TSK 4* *Standard* *Performance rating of 2 on each criteria*	75

MODULE MEC109: ELECTRICAL FUNDAMENTALS (continued)

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will: • demonstrate effort to develop basic competencies.	*Assessment of student assessment will be based on:* • observations of individual effort and interpersonal exploration during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Safety and Environmental Concerns	*The student should:* • safely use tools/equipment and follow established lab procedures • be aware of causes of battery explosion/acid burner • be aware of electrical shock/burns/fires • outline a plan of action when an accident occurs.	Face/eye protection when working around batteries.
Magnetism and Electricity	• observe and describe magnetic attraction and repulsion between two magnets • produce a temporary and permanent magnet • determine the polarity of an electromagnet.	
Electricity and the Atom	• describe the electron theory in relation to the parts of an atom.	
Producing Electricity	• describe production of electricity: – chemically – thermally – photoelectrically – piezoelectrically – electromagnetically • explain the difference between AC and DC current.	Static charges: how produced and effect on a vehicle.

Concept	Specific Learner Expectations	Notes
Electrical Circuits	*The student should:* • identify and label the parts of a simple circuit • recognize the physical form and circuit symbol of a: – light – motor – heating element – solenoid – fuse – other • construct and compare a series and a parallel circuit • determine what conditions create: – an open circuit – a closed circuit – other • describe how a frame-ground circuit operates on a motor vehicle.	Develop a working model, block diagrams of lighting, starting charging system.
Electrical Measurement	• define what is meant by: – amperage – voltage – resistance • compare these factors with factors in a fluid system • measure, with appropriate meters, the resistance, voltage and amperage in a given circuit • determine the relationship that exists among the amperage, voltage and resistance within a circuit • determine condition of a battery and service.	Battery explosion precaution.
Career Exploration	• identify further education and work opportunities related to electrical fundamentals.	

MODULE MEC111: PNEUMATIC AND HYDRAULIC SYSTEMS

Level: **Introductory**

Theme: **Guidance and Control Systems**

Prerequisite: **None**

Module Parameters: Access to related pneumatic/hydraulic units and resources

Students focus on the operating principles and applications of pneumatic and hydraulic systems.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• demonstrate the safe use of tools and follow established lab procedures	• observed performance related to: – recognition of dangers involved when working with pressurized pneumatic and hydraulic systems – clean-up of hydraulic fluids – selection and safe use of tools. *Assessment Tool* *Safety–Care Checklist, MEC SAF 1* *Standard* *Performance rating of 2 on each criteria*	15
• compare the operating principles of pneumatic and hydraulic systems	• report comparing operating principles of pneumatic and hydraulic systems indicating: – units involved – sample systems on vehicles – employment opportunities. *Assessment Tool* *Report Assessment Form, MEC REP 2* *Standard* *Performance rating of 2 on each criteria*	35

MODULE MEC111: PNEUMATIC AND HYDRAULIC SYSTEMS (continued)

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• apply the principles and concepts related to the use of pneumatic and hydraulic systems	• observed performance in recognizing and using one pneumatic and one hydraulic system. *Assessment Tool* *Task Assessment Checklist, MEC TSK 4* *Standard* *Performance rating of 2 on each criteria*	50
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal exploration during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Safety and Environmental Concerns	*The student should:* • follow laboratory safety procedures • list hazards related to working with fluids under pressure and related equipment • list hazards related to pneumatics.	
Fluid Systems	• state why fluid systems are widely used in transportation and power application • contrast hydraulic and pneumatic systems.	
Fluids Under Pressure	• observe and demonstrate how pressure affects a liquid and a gas in an enclosed space • determine what units are used to measure pressure in a fluid.	
Fluids in Motion	• determine what units are used to calculate the flow of fluid past a point • demonstrate the relationship between flow rate and pressure in a fluid system.	

Concept	Specific Learner Expectations	Notes
Developing Fluid Power	*The student should:* • contrast the action of common pumps and compressors such as: – impeller – gear – piston – diaphragm – vane type • locate examples of these pumps and compressors in a motor vehicle or some other power system.	
Controlling Fluid Power	• observe and demonstrate the use of valves to control the: – direction of fluid motion – pressure of fluids – flow rate of fluids • locate valves on a given vehicle • double flare a steel line.	
Using Fluid Power	• observe and demonstrate how fluids under pressure can be used to move a: – motor – cylinder – diaphragm • identify the above units on a given vehicle.	
Increasing Force with Fluids	• examine how a small force can be multiplied in a fluid system • describe the principles in a fluid system such as: – hydraulic hoist – hydraulic brakes.	
Career Exploration	• identify further education and work opportunities related to pneumatic and hydraulic systems.	

MODULE MEC113: MECHANICAL SYSTEMS

Level: **Introductory**

Theme: **Guidance and Control Systems**

Prerequisite: **None**

Module Parameters: **Access to example of mechanical units and related resources**

Student focus on the operating principles and applications of mechanisms that are used to transmit and control mechanical energy.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• demonstrate the safe use of tools and follow established lab procedures	• observed performance related to: – following established shop/lab routines – proper selection and safe use of tools. *Assessment Tool* *Safety–Care Checklist, MEC SAF 1* *Standard* *Performance rating of 2 on each criteria*	15
• describe the principles and concepts related to the use of mechanisms to control and transmit force and motion in a vehicle	• report listing/describing and providing sample applications of the following: – simple levers – types of mechanical motion – direct and indirect power transmission units – conversion of mechanical energy. *Assessment Tool* *Report Assessment Form MEC REP 2* *Standard* *Performance rating of 2 on each criteria*	35

MODULE MEC113: MECHANICAL SYSTEMS (continued)

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• apply the principles and concepts of mechanical systems	• observed performance on a given mechanical unit determining the following: – determine torque and gear ratio – mechanical advantage – coefficient of friction. *Assessment Tool* *Task Assessment Checklist, MEC TSK 4* *Standard* *Performance rating of 2 on each criteria*	50
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal exploration during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Safety and Environmental Concerns	*The student should:* • follow laboratory safety procedures.	
Mechanical Systems	• discuss the application of mechanical systems that are found in all aspects of human endeavour • demonstrate the use of simple machines to change the: – direction in which a force acts – size of the force – place where the force acts.	Group activity.

Concept	Specific Learner Expectations	Notes
Types of Mechanical Motion	*The student should:* • devise or locate a mechanism that produces: – linear motion – reciprocating motion – oscillating motion – rotary motion – other • observe and graph the action of a cam as it changes rotary motion to linear motion.	Bicycle drive mechanism. Model engines.
Direct Power Transmission	• explain the difference between direct and indirection transmission of power • describe the purpose and types of: – shafts – couplers – universal joints – pins – others.	Use of sample transmissions/rear axles; e.g., • lawn mowers (self-propelled) • riding mowers • basic automobile, transmissions, drive shafts, differentials.
Indirect Power Transmission and Control Using Simple Machines	• observe and demonstrate the use of simple machines to: – start and stop motion – change directions – increase or decrease speed – increase or decrease torque • describe the relationship between torque and velocity/gear ratios.	10-speed bicycle transmissions.
Friction	• explain why friction has both positive and negative attributes • compare the coefficient of friction between two different materials • determine how friction can be increased or decreased in a mechanical system.	Use/construct unit similar to oil additive demonstration unit.
Efficiency	• calculate the mechanical advantage of one or more mechanisms to determine the efficiency of the system.	

Concept	Specific Learner Expectations	Notes
Converting Mechanical Energy	*The student should:* • explain how mechanical energy can be changed to: – heat energy – electrical energy – fluid energy – other.	

MODULE MEC115: RIDE AND CONTROL SYSTEMS

Level: **Introductory**

Theme: **Suspension and Structural Systems**

Prerequisite: **None**

Module Parameters: **Access to floor jack, safety stands, suspension/steering system and related resources**

Students develop a basic knowledge of ride and control mechanisms associated with vehicles.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• demonstrate the safe use of tools and follow established lab procedures	• observed performance related to: – use of floor jack and safety stands – following established shop/lab routines. *Assessment Tool* *Safety–Care Checklist, MEC SAF 1* *Standard* *Performance rating of 2 on each criteria*	15
• describe the purpose, operation and interdependent nature of ride and control systems	• report showing purpose and operation of suspension, steering and braking system used on: – land vehicles – aircraft. *Assessment Tool* *Report Assessment Form, MEC REP 2* *Standard* *Performance rating of 2 on each criteria*	35
• inspect and service ride and control systems	• observed performance in inspecting/servicing suspension, steering and brake systems including the following: – labeling and checking parts subject to wear – repacking a wheel bearing. *Assessment Tool* *Task Assessment Checklist, MEC TSK 4* *Standard* *Performance rating of 2 on each criteria*	50

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will: • demonstrate effort to develop basic competencies.	*Assessment of student assessment will be based on:* • observations of individual effort and interpersonal exploration during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Safety and Environmental Concerns	*The student should:* • follow established safety procedures.	
Ride and Control Systems	• locate and identify the components that are used to provide: – stopping action – directional control – rolling action and traction – stabilization – cushioning – other.	
Steering Systems	• describe methods of directional control • describe the method of steering used by most wheeled vehicles • examine and explain the purpose of the parts of a conventional steering system; e.g., steering gear, tie rod end, idler arm, pitman arm and steering knuckle • list the parts of a steering system that are subject to wearing or bending • inspect and repack wheel bearing.	Airplanes, tracked.

MODULE MEC115: RIDE AND CONTROL SYSTEMS (continued)

Concept	Specific Learner Expectations	Notes
Braking Systems	*The student should:* • identify and describe the action of the following types of braking systems and possible application: – mechanical – hydraulic – electric – air – other • explain the difference between the braking action of a disc and drum brake • list and identify the parts of a braking system that are subject to wearing, seizing or leaking.	
Tires and Track Systems	• determine how tires and tracks vary according to: – road or terrain use – seasonal use – methods of construction • examine the wear pattern on a tire to determine whether it has been: – over or under inflated – improperly aligned – subject to suspension faults – balanced improperly.	Tire balance and repair optional. The construction, highway, off-highway.

MODULE MEC116: VEHICLE STRUCTURES AND MATERIALS

Level: **Introductory**

Theme: **Suspension and Structural Systems**

Prerequisite: **None**

Module Parameters: **Access to vehicle, hand tools, fasteners, materials and related resources**

Students identify the types of materials and components that are used in a vehicle's construction.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• demonstrate the safe use of tools and follow established lab procedures	• observed performance related to: – recognition of health hazards associated with coated surfaces – how hazardous materials are handled and disposed of – following lab/shop established routines. *Assessment Tool* *Safety–Care Checklist, MEC SAF 1* *Standard* *Performance rating of 2 on each criteria*	15
• determine the relationship between the function of a vehicle and the materials used in its construction	• report indicating how function of a vehicle dictates construction material in: – interior components – exterior components. *Assessment Tool* *Report Assessment Form, MEC REP 2* *Standard* *Performance rating of 2 on each criteria*	30

MODULE MEC116: VEHICLE STRUCTURES AND MATERIALS (continued)

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will: • examine and identify the basic parts and materials used in the construction of a vehicle	*Assessment of student assessment will be based on:* • observed performance in identification of vehicle structures parts and materials. *Assessment Tool* *Task Assessment Checklist, MEC TSK 4* *Standard* *Performance rating of 2 on each criteria*	50
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal exploration during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Safety and Environmental Concerns	*The student should:* • state health and environmental issues related to the replacement and repair of coated surfaces • state how hazardous materials are handled and disposed of.	
Recycling	• determine what parts of a vehicle are recyclable • cite examples of initiatives that will increase the percentage of parts that can be recycled.	
History of Materials Used in Transportation Vehicles	• trace the historical development of materials used in transportation vehicles • identify and discuss the factors that have contributed to the use and development of new structural materials.	

Concept	Specific Learner Expectations	Notes
Material Identification and Selection	*The student should:* • identify the monoliths and composite materials used in a modern vehicle • determine the most appropriate methods of identifying the type of materials used in a part or structure • examine and describe the action of a coil spring when subject to rapid loading • identify the factors used to select a material for a given function.	This module could be a vehicle dismantling project—group work possibilities.
Structural Engineering	• indicate how design and construction of a vehicle is affected by the media (land, sea, air, space) that it operates in • identify design features that are tied more closely to consumer taste than function • list ways government regulations have altered the design and construction of vehicles • examine a vehicle and describe what steps have been taken to: – reduce its weight – reduce drag – increase passenger safety – increase longevity of structural parts – improve passenger comfort and space.	*Highway Traffic Act.*
Fasteners	• know common types of fasteners used, such as: – studs, bolts, screws – nuts – rivets – clips – clamps.	
Structural Coatings and Seals	• identify what coatings are used to: – protect against corrosion – add to the appearance – reduce effects of the sun's radiation – reduce noise.	

Concept	Specific Learner Expectations	Notes
Career Exploration	*The student should:* • investigate growth occupations that are associated with transportation vehicles.	Designing, building, recycling.

MODULE MEC117: METAL FORMING AND FINISHING

Level: Introductory

Theme: Suspension and Structural System

Prerequisites: Vehicle Structures and Materials (MEC116; recommended)
Oxyacetylene Welding (FAB104; recommended)

Module Parameters: Access to oxy-fuel welding equipment, basic autobody hand/power tools, basic metal refinishing material and resources

Students create and form metal panels.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student achievement will be based on:*	
• demonstrate safe practices when metal forming and finishing	• observed performance related to: – following established lab/shop procedures – safe use of tools/equipment related to metal forming and finishing – recognize and follow personal protective procedures. *Assessment Tool* *Safety–Care Checklist, MEC SAF 1* *Standard* *Performance rating of 3 on each criteria*	15
• research effects of distortion and corrosion on sheet metal	• report indicating effects of distortion and corrosion on ferrous sheet metal including: – characteristics of sheet metal – work hardening of sheet metal. *Assessment Tool* *Report Assessment Form, MEC REP 2* *Standard* *Performance rating of 2 on each criteria*	30

MODULE MEC117: METAL FORMING AND FINISHING (continued)

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• repair minor damage in a panel	• observed performance in correcting: – minor dent in a panel – small rust out in a panel. *Assessment Tool* *Task Assessment Checklist, MEC TSK 4* *Standard* *Performance rating of 2 on each criteria*	50
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal exploration during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Safety and Environmental Concerns	*The student should:* • demonstrate safe practices in relation to: – personal protective equipment/clothes – use impact tools, drills, grinders, cutters, sheet metal brake and shear – safely use oxy-acetylene/MIG welding equipment – hazards of body fillers.	
Sheet Metal Characteristics	• understand properties of: – low carbon steels – high strength steels.	Types of steel; work hardening; affects of impact forces.
Metal Forming	• list tools and equipment available shaping sheet metal • identify the process required for specific types of shaping.	Stretching, shrinking.

Concept	Specific Learner Expectations	Notes
Minor Dent Repair	*The student should:* • identify processes for metal working and repairing small dents.	Mild sheet metal distortion; pry bar, pulling tools; hammering techniques. Paintless dent repair.
Small Rust Out Repair	• describe possible methods of repair • determine the best method of repair • complete the repair.	Fibreglass, welded patches.
Metal Finishing	• pick panel to smooth contour • file and grind panel to desired finish • complete operation by sanding.	
Plastic Fillers	• identify various filler materials available • determine the suitable type of filler to be used • prepare the surface and fillers for application • apply fillers and finish.	Fibreglass, aluminum, light/premium, polyester.

MODULE MEC119: SURFACE PREPARATION I

Level: **Introductory**

Theme: **Suspension and Structural Systems**

Prerequisite: **None**

Module Parameters: **Access to painting facilities, surface preparation tools/materials and related resources**

Students assess the state of a surface and follow restoration procedures.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student achievement will be based on:*	
• demonstrate safe practices when doing surface preparation	• observed performance related to: – following established lab/shop routines with respect to abrasive dust and chemical fumes – safe use of tools/equipment and use of hazardous materials. *Assessment Tool* *Safety–Care Checklist, MEC SAF 1* *Standard* *Performance rating of 3 on each criteria*	15
• identify products, equipment and procedures associated with surface preparation	• report indicating the following for surface preparation: – list of conditions and appropriate repair procedures – list of abrasives/alternatives and how they are used – list of tools/equipment required. *Assessment Tool* *Report Assessment Form, MEC REP 2* *Standard* *Performance rating of 2 on each criteria*	35

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will: • analyze, prepare and perform a surface preparation	*Assessment of student assessment will be based on:* • performance in doing a surface preparation observing: – proper analysis – preparation of panel – masking panel. *Assessment Tool* *Task Assessment Checklist, MEC TSK 4* *Standard* *Performance rating of 2 on each criteria*	50
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal exploration during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Safety and Environmental Concerns	*The student should:* • demonstrate safe practices in relation to: – abrasive dust – chemicals/fumes.	Grinding, sandblasting; paint stripping; strippers. Potential health hazards.
Surface Conditions	• determine problem conditions in painted surfaces • identify tools, equipment that must be used.	Paint oxidized, peeled, chips, rust, cracking.
Preparation	• list types of equipment/tools used in surface preparation processes • list types of abrasives used in surface preparation • explain and demonstrate methods of sanding • identify alternative method of surface preparation; e.g., chemical stripping, blasting • identify condition and use appropriate methods of surface preparation.	

Concept	Specific Learner Expectations	Notes
Basic Bare Metal Treatment	*The student should:* • identify and apply metal conditioner.	
Undercoats	• know types, purpose and methods of applying undercoats • understand types and uses of putties.	
Basic Masking	• identify methods of masking • list equipment used in masking • mask a number of different projects.	Masking tape, foam tape, liquid masking, paper types.

MODULE CURRICULUM AND ASSESSMENT STANDARDS: INTERMEDIATE LEVEL

The following pages define the curriculum and assessment standards for the intermediate level of Mechanics.

Intermediate level modules help students build on the competencies developed at the introductory level and focus on developing more complex competencies. They provide a broader perspective, helping students recognize the wide range of related career opportunities available within the strand.

Module MEC201:	Vehicle Detailing	E.3
Module MEC202:	Vehicle Maintenance	E.7
Module MEC203:	Lubrication and Cooling Systems	E.13
Module MEC204:	Fuel and Exhaust Systems	E.17
Module MEC205:	Alternate Fuel Engines	E.21
Module MEC206:	Ignition Systems	E.23
Module MEC207:	Emission Controls	E.27
Module MEC209:	Electrical Components	E.31
Module MEC210:	Power Assist Accessories	E.35
Module MEC211:	Braking Systems	E.39
Module MEC212:	Hydraulic Accessories	E.43
Module MEC213:	Power Trains	E.47
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Module MEC215:	Suspension Systems	E.59
Module MEC216:	Steering Systems	E.63
Module MEC217:	Metal Repair and Finishing	E.67
Module MEC218:	Trim Removal and Installation	E.71
Module MEC219:	Surface Preparation II	E.75
Module MEC220:	Refinishing I	E.77
Module MEC221:	Basic Touch-up and Finishing	E.81
Module MEC222:	Interior Finishes and Repairs	E.85

MODULE MEC201: VEHICLE DETAILING

Level: **Intermediate**

Theme: **Vehicle Design and Ownership**

Prerequisite: **None**

Module Parameters: **Access to commercially available products and related resources**

Students develop the skills required to restore and enhance the exterior finishes of a vehicle.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• state personal and environmental hazards associated with the use of cleaning and waxing agents	• presentation of a report describing: – hazards associated with use of cleaning and waxing – environmental concerns in the use of cleaning agents – solutions to the described hazards. *Assessment Tool* *Report Assessment Form, MEC REP 2* *Standard* *Performance rating of 2 on each criteria*	15
• describe materials available to enhance the appearance of a vehicle	• identification of materials and products used in the detailing of a vehicle by providing a list including: – surface enhancing material – trim additions. *Assessment Tool* *Report Assessment Form, MEC REP 2* *Standard* *Performance rating of 2 on each criteria*	15
• demonstrate the correct cleaning and treatment of exterior finishes including paint, glass, vinyl and rubber body and engine parts	• observed performance in vehicle cleaning and enhancement. *Assessment Tool* *Task Assessment Checklist, MEC TSK 4* *Standard* *Performance rating of 2 on each criteria*	20

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• install a trim or accessory part according to standard practice	• observed performance in a trim installation including: – correct use of tools and following safety procedures – identification of parts – use of instruction manual. *Standard* *Performance rating of 2 on each criteria* *Assessment Tool* *Task Assessment Checklist, MEC TSK 4*	50
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal exploration during the instructional period. *Assessment Tools* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
Safety and Environmental Concerns	• follow safety rules and procedures in the handling of dangerous cleaning agents.	WHMIS. Preferred environmentally friendly products.
Exterior Enhancement and Protection	• identify and practise the correct procedures when using cleaning and polishing/treatment agents on various materials • identify surface flaws and solutions that could be used other than spray painting • explain the value of using waxes to treat painted surfaces (including longevity and monetary).	Paintless dent repair.

MODULE MEC201: VEHICLE DETAILING (continued)

Concept	Specific Learner Expectations	Notes
Trim Fasteners and Installation	*The student should:* • identify, through research, four or more kinds of clips, two-way tape and adhesive • learn, through practice, the procedures used to remove and replace trim parts, the correct use of tools involved, and the value of these parts • list the precautions needed to prevent damage to trim or adjacent surfaces when removing and replacing trim parts.	Silicone-free products.
Trim Products	• demonstrate the application of decals, pin striping and/or molding as a method of enhancing vehicle appearance • demonstrate the ability to follow installation instructions by completing an accessory installation project • explain the value and methods used to enhance the appearance of a vehicle without painting.	
Engine Detailing	• demonstrate safe handling and application of volatile cleaners used for engine cleaning • follow procedures outlined to prevent damage to electrical or other parts when cleaning • identify hazards that are present, including acid powder • use materials available to complete an engine clean and, if possible, install enhancing materials such as paints or coatings • describe the value of maintaining a clean and neat engine area.	

MODULE MEC202: VEHICLE MAINTENANCE

Level: **Intermediate**

Theme: **Vehicle Design and Ownership**

Prerequisite: **Vehicle Service and Care (MEC102; recommended)**

Module Parameters: **Access to vehicles, specialty tools, hand tools and related resources**

Instructional Qualification: Client work to be checked by certified technician when work performed on brakes, steering and suspension

Students execute basic service requirements necessary to ensure the adequate maintenance of a motor vehicle.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• demonstrate established safety procedures and care when working with vehicles	• observed performance in: – following established lab/shop routines – use of WHMIS information as it applies to oil, grease, gasoline and antifreeze – working with others – proper and safe use of tools/equipment. *Assessment Tool* *Safety–Care Checklist, MEC SAF 1* *Standard* *Performance rating of 3 on each criteria*	15
• identify service requirement of a vehicle as per manufacturer's recommendations	• given a vehicle, generate a service schedule indicating: – make, model, year and serial number – system or unit to be checked – time, mileage, service condition. *Assessment Tool* *Report Assessment Form, MEC REP 2* *Standard* *Performance rating of 2 on each criteria*	15

MODULE MEC202: VEHICLE MAINTENANCE (continued)

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• conduct a motor vehicle inspection in keeping with the age of the vehicle, distance traveled, service conditions and history	• observed performance: – completeness of inspection according to generated schedule – inspecting engine cooling, fuel, exhaust, ignition emission, lubrication and mechanical system – inspecting power train, running gear and body. *Assessment Tool* *Task Assessment Checklist, MEC TSK 4* *Standard* *Performance rating of 2 on each criteria*	25
• service and repair a motor vehicle according to the vehicle condition and service schedule •	• observed performance in servicing a given vehicle according to the schedule. *Assessment Tool* *Task Assessment Checklist, MEC TSK 4* *Standard* *Performance rating of 2 on each criteria*	45
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal exploration during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Safety and Environmental Concerns	*The student should:* • follow lab safety procedures.	WHMIS and school district's guidelines.
Service Scheduling	• identify the service requirements for a specific motor vehicle considering the odometer reading, conditions of operation and service history.	

MODULE MEC202: VEHICLE MAINTENANCE (continued)

Concept	Specific Learner Expectations	Notes
	The student should:	
Engine Maintenance		
• Lubrication System	• inspect engine for oil leaks	
	• renew engine gaskets or seals, where necessary	
	• change engine oil and filter	
	• service PCV valve and breather	
• Cooling System	• inspect the condition of coolant, hoses, belts, fan and radiator; adjust belts if required	
	• change or recondition the engine coolant and flush the cooling system, if required	
	• pressure test the system	
	• replace the thermostat, if necessary	
• Fuel System	• locate and inspect the fuel filter; replace if required	
	• replace the air filter, if required	
	• inspect and service throttle linkage	
• Exhaust System	• inspect manifolds, pipes, catalytic converter, muffler and hangers for structural integrity; repair as required	
• Ignition System	• inspect and either service or replace as required by the service schedule: – spark plugs – distributor cap and rotor – spark plug wires and boots	 Optional. Optional.
• Emission Control System	• inspect and replace fuel purge canister filter, if required	Optional.
• Mechanical System	• determine condition of the camshaft timing belt or chain and recommend the appropriate service	Compare with manufacturer's specifications.

Concept	Specific Learner Expectations	Notes
• Power Transmission System	*The student should:* • inspect and replace fluids as required in the following components: – automatic transmission – manual transmission – transaxle – transfer case – differential assembly • inspect and recommend service for constant velocity joints, seals, drive shaft, drive axles and U-joints.	Jacking/hoisting systems.
Running Gear • Tires	• investigate tire condition and relate condition to probable cause and replacement necessity • mount and balance tires • rotate tires to maximize wear life	
• Steering and Suspension	• inspect and assess the service condition of steering and suspension system components • inspect and repack wheel bearing • lubricate steering and suspension system joints • recommend further service requirements of the system • replenish fluids in hydraulic pump	
• Brakes	• inspect and assess the wear characteristics of disc brake and drum brake components • lubricate parking brake linkages • top up brake fluid reservoir • assess the system fluid integrity and brake pedal feel relative to repair requirements.	

MODULE MEC202: VEHICLE MAINTENANCE (continued)

Concept	Specific Learner Expectations	Notes
Electrical System	*The student should:* • inspect and service battery and battery clamps, renew clamps if required • adjust alternator belt tension if necessary • check the operation of all lights and replace required bulbs • inspect fuse panel and renew inoperative fuses • using a voltmeter, test the alternator charging voltage • recommend further repair requirements.	Hazards when working with lead-acid storage batteries.
Body	• lubricate hinges on all opening panels and weather strips • lubricate locks or lock plates, as required • inspect and change windshield wiper blades, if necessary • inspect for loose trim or moldings.	Good resource: vehicle write-off inspection form for total module.

MODULE MEC203: LUBRICATION AND COOLING SYSTEMS

Level: **Intermediate**

Theme: **Propulsion Systems**

Prerequisite: **Engine Fundamentals (MEC104; recommended)**

Module Parameters: **Access to pressure tester, hand tools and related resources**

Students diagnose, maintain and service the lubrication and cooling systems on a typical four-cycle gasoline engine.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will: • demonstrate safe work habits associated with fluids	*Assessment of student assessment will be based on:* • observed performance related to: – appropriate selection of personal and vehicle protective equipment when working with oils, flushes and antifreeze – maintains an organized workplace – maintains a tidy workplace – uses correct tools and materials in a safe and efficient manner – uses appropriate fluids for oil changes/cooling systems – ensures used fluids are placed in appropriate containers and disposed *Assessment Tool* *Safety–Care Checklist, MEC SAF 1* *Standard* *Performance rating of 3 on each criteria*	10
• recognize the relationship between engine performance and the design and condition of the lubrication and cooling systems	• observed performance related to: – analysis of condition of lubrication system/cooling system based on visual checks, pressure tests, and service records of vehicle – checks for fluid leaks – checks for worn or damaged parts. *Assessment Tool* *Task Assessment Checklist, MEC TSK 4* *Standard* *Performance rating of 2 on each criteria*	20

MODULE MEC203: LUBRICATION AND COOLING SYSTEMS (continued)

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• interpret service manual procedures and specifications relative to lubrication and cooling systems	• observed performance related to: – appropriate use of service manuals – ability to locate required information – use of information to predict quantities of fluids required for servicing lubrication systems/cooling systems. *Assessment Tool* *Information Retrieval Checklist (To be developed)* *Standard* *Performance rating of3 on each criteria*	30
• diagnose and correct lubrication and cooling system problems	• performance in diagnosing and repairing lubrication and cooling system faults. *Assessment Tool* *Task Assessment Checklist, MEC TSK 4* *Standard* *Performance rating of 2 on each criteria*	40
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal exploration during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Safety and Environmental Concerns	*The student should:* • follow all safety procedures associated with hot fluids and fluids under pressure • collect and dispose of all hazardous fluids in the appropriate manner • remove all spills from work area.	WHMIS materials. To environmental standards.
Lubrication Systems • Function	• identify the multiple tasks performed by the lubrication system	

Concept	Specific Learner Expectations	Notes
	The student should:	
• Lubrication Oils	• determine the properties of an engine lubricant intended for use in a late model engine	
	• interpret the meaning of the American Petroleum Institute (API) symbol and viscosity numbers used on oil containers	
• Components	• observe the design and operation of a: – gear and rotor-type oil pump – pressure regulator or relief valve – oil pressure sensor gauge or indicator – oil level and change indicator	
• Inspection and Servicing	• identify possible cause of low/high oil pressure and high levels of oil consumption under normal operating conditions	
	• inspect engine for oil leaks owing to gasket/seal failure	
	• replace seal/gaskets if necessary	
	• disassemble and inspect a gear or rotor pump for pitting and galling or abnormal wear	Sample pumps.
	• test oil pressure sensor; replace if necessary.	
Cooling System		
• Function	• explain the function of the cooling system	
• Coolants	• determine the relationship between the percentage of antifreeze and water to the coolant's freezing and boiling points	
	• establish the most appropriate percentage to meet local conditions	
• Components	• observe the design and operation of a: – radiator and cap – thermostat – water pump – radiator – fan – hoses – recovery tank – block heater	Fan direct clutch and electric.

Concept	Specific Learner Expectations	Notes
• Inspection and Servicing	*The student should:* • identify possible causes for engine overheating or running cold under normal operating conditions • inspect hoses for cracks, soft spots and leaks; replace if necessary • test thermostat; replace if necessary • inspect radiator for leaks, blockages; replace if necessary • check condition and tension of fan belt; replace if necessary.	If activities are not done on live units, have students perform them on shop units.
Career Opportunities	• identify further education and work opportunities related to aftermarket parts supply and rebuilding.	

MODULE MEC204: FUEL AND EXHAUST SYSTEMS

Level: **Intermediate**

Theme: **Propulsion Systems**

Prerequisite: **Engine Fundamentals (MEC104; recommended)**

Module Parameters: **Access to ventilated area, fuel pump vacuum/pressure tester and related resources**

Students diagnose, maintain and service the fuel and exhaust system on a typical four-cycle gasoline engine.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• demonstrate safe habits associated with volatile liquids and combustion gases	• observed performance related to – following safe practices and proper use of containers, safety devices, tools and equipment while working on fuel and exhaust systems – following shop routines and precautions – proper use of fire extinguishers, containers, measuring devices, pressure meters and related tools and equipment. *Assessment Tool* *Task Assessment Checklist, MEC TSK 4* *Standard* *Performance rating of 3 on each criteria*	10
• recognize the relationship between vehicle performance and fuel type engine design and condition of the fuel and exhaust systems	• description of the importance and effects of air fuel ratio to correct combustion – describe the symptoms associated with a rich mixture–lean mixture – discuss air flow, atomizing pre- and post-ignition. *Assessment Tool* *Report Assessment Form, MEC REP 2* *Standard* *Performance rating of 2 on each criteria*	25

MODULE MEC204: FUEL AND EXHAUST SYSTEMS (continued)

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• accurately interpret service manual procedures and specifications relative to fuel and exhaust systems	• demonstrated performance in applying procedures and specifications outlined in service manuals related to fuel and exhaust systems. *Assessment Tool* *Task Assessment, Checklist, MEC TSK 4* *Standard* *Performance rating of 3 on each criteria*	15
• diagnose and correct fuel and exhaust system faults	• observed performance related to: – correct diagnoses of fuel and exhaust system faults – adjustments to fuel system – tests of fuel system – repairs to fuel and exhaust systems. *Assessment Tool* *Task Assessment, Checklist, MEC TSK 4* *Standard* *Performance rating of at least 3 on each criteria*	50
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal exploration during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Safety and Environmental Concerns	*The student should:* • follow all safety procedures associated with volatile liquids and exhaust gases • store fuels and solvents in the appropriate manner • maintain proper venting and air supply in the work area.	Gasoline spills, carbon monoxide dangers.

Concept	Specific Learner Expectations	Notes
Gasoline Fuels	*The student should:* • describe the chemical composition of gasoline and the effect complete and incomplete combustion have on the environment and engine performance • determine the characteristics of a quality gasoline in relation to its volatility and octane rating • identify measures that are taken to: – prevent the formation of gum deposits – prevent the oxidation of metal parts – retard icing – aid in the identification of fuel types and grades.	
Engine Design	• determine the factors that affect combustion, such as: – spark plug location – combustion chamber size and shape – compression ratio – valve and part design – spark timing, duration and intensity – air temperature and fuel ratio – manifold pressures – valve timing, life and duration.	
Fuel System Components	• identify and describe the function of the major fuel system components • explain the difference between a carburetor and a fuel injected system • identify the common problems associated with carburetors and fuel injected systems. • clean and adjust a typical carburetor on and off an engine • visually inspect and test a typical fuel injection system • test fuel pump pressure and capacity; repair or replace if necessary.	

Concept	Specific Learner Expectations	Notes
Exhaust System Components	*The student should:* • locate and describe the function of the major exhaust system components • visually inspect and test for exhaust leaks or blockages; replace converters, pipes, mufflers if necessary.	Effect of a blocked exhaust system

MODULE MEC205: ALTERNATE FUEL ENGINES

Level: **Intermediate**

Theme: **Propulsion Systems**

Prerequisite: **Engine Fundamentals (MEC104; recommended)**

Module Parameters: **Access to related resources, basic hand tools**

Students explore the use of alternate fuels used to power motor vehicles.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• demonstrate safety relative to alternate fuel vehicles	• observed performance related to: – appropriate personal and vehicle safety procedures when starting, stopping, parking and refueling alternate fuel vehicles – safe storage of alternate fuels. *Assessment Tool* *Safety–Care Checklist, MEC SAF 1* *Standard* *Performance rating of 3 on each criteria*	20
• determine the type of fuel that is best suited to a particular type of vehicle and application	• ability to identify alternate fuels which are best suited to particular tasks and requirements. *Assessment Tool* *Report Assessment Form, MEC REP 2* *Standard* *Performance rating of 3 on each criteria*	35
• service an alternate fueled vehicle, recognizing its unique maintenance requirements	• performance in servicing an alternate fueled vehicle. *Assessment Tool* *Task Assessment Checklist, MEC TSK 4* *Standard* *Performance rating of 3 on each criteria*	45
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal exploration during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

MODULE MEC205: ALTERNATE FUEL ENGINES (continued)

Concept	Specific Learner Expectations	Notes
Safety and Environment Concerns	*The student should:* • follow lab safety procedures • state how alternate fuels affect the environment.	Dangers involved in working on vehicles using, e.g., propane, natural gas.
Types of Alternate Fuel	• identify the typical alternate fuels; e.g., – diesel – propane – methanol – natural gas – hydrogen • compare the heat-producing characteristics of each fuel • identify resources and methods of marketing different types of fuel.	BTU charts from oil companies.
Engine Modifications	• describe the engine design modifications that are required to operate on: – diesel – propane – methanol – others.	
Application	• determine the advantages of using an alternate fuel by considering: – fuel cost – availability – performance – engine life – environmental impact.	
Engine Service and Maintenance	• determine the specific service requirement for an alternate fuel engine • complete a service and maintenance task according to the manufacturer's recommendations; e.g., change fuel filter, engine lubricant and oil filter.	

MODULE MEC206: IGNITION SYSTEMS

Level: **Intermediate**

Theme: **Propulsion Systems**

Prerequisite: **Electrical Fundamentals (MEC109; recommended)**

Module Parameters: **Access to multimeter, timing light, hand tools and related resources**

Students become familiar with the basic components and parts of ignition systems used on internal combustion engines.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• interpret and apply instruction manuals and follow electrical safety guidelines	• observation based on: – retrieval of information from instruction manuals – application of information – safe use of materials – safety for self, vehicle and fellow students. *Assessment Tool* *Report Assessment Form, MEC REP 2* *Standard* *Performance rating of at least 3 on each criteria*	10
• explain how a timed high voltage spark is achieved in a magneto, point type and electronic ignition system	• ability to explain how the parts of magneto, point and electronic ignition systems interrelate to produce timed ignition spark. *Assessment Tool* *Report Assessment Form, MEC REP 2* *Standard* *Performance rating of 3 on each criteria*	20
• recognize the driving symptoms and use visual and instrument checks to diagnose ignition system faults	• observation based on – ability to use instruments – ability to do visual tests in order to correctly diagnose ignition faults – ability to analyze drivability symptoms. *Assessment Tool* *Task Assessment Checklist, MEC TSK 4* *Standard* *Performance rating of 3 on each criteria*	30

MODULE MEC206: IGNITION SYSTEMS (continued)

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• test and repair ignition system	• observed performance in: – testing point ignition system – testing electronic ignition system – correcting a defective system. *Assessment Tool* *Task Assessment Checklist, MEC TSK 4* *Standard* *Performance rating of 3 on each criteria*	40
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal exploration during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Safety and Environmental Concerns	*The student should:* • follow lab safety procedures.	
Ignition Systems	• list and describe the three common types of ignition systems • name the parts of a: – magneto – point type – electronic ignition system – DIS.	Distributor-less ignition.

MODULE MEC206: IGNITION SYSTEMS (continued)

Concept	Specific Learner Expectations	Notes
Ignition Symptoms	*The student should:* • recognize and describe symptoms produced by a typical part failure; e.g., – loose connection – faulty spark plug – faulty spark plug or coil wire – bad distributor cap or rotor – faulty points – faulty coil – other.	
Ignition Testing	• test the following: – primary circuit voltage drop – high tension lead resistance – ignition coil – ignition cap – distributor points and condensor – advance mechanisms.	
Engine Condition	• remove and analyze a spark plug to determine how well the engine is operating; e.g., oil consumption, fuel/air ratio.	
Ignition Maintenance	• lubricate distributor • clean and tighten electrical leads and connections.	
Ignition Servicing	• complete the following according to the manufacturer's specifications: – clean gap and/or replace with new spark plugs – clean and/or replace with new contact points – adjust contact points and pick up coil gap – adjust/repair advance mechanisms – set ignition timing statically and check with a timing light.	

MODULE MEC207: EMISSION CONTROLS

Level: Intermediate

Theme: Propulsion Systems

Prerequisites: Engine Fundamentals (MEC104)
Lubrication and Cooling Systems (MEC203)
Fuel and Exhaust Systems (MEC204)
Ignition Systems (MEC206; recommended)

Module Parameters: Access to optional specialized equipment and related resources

Students gain an understanding of the importance of controlling emissions and the technology applied to vehicles in order to meet prescribed standards.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• demonstrate safety procedures relative to emission control system	• observed performance related to: – safety procedures in use of tools and equipment related to vehicle emissions – appropriate selection of and use of protective equipment. *Assessment Tool* *Safety–Care Assessment Form, Checklist, MEC SAF 1* *Standard* *Performance rating of 3 on each criteria*	10
• understand the types and characteristics of pre- and post-combustion emissions	• ability to describe and demonstrate – types of pre- and post-combustion emission control systems – identify parts of pre- and post-combustion emission systems – describe the function of parts on both pre- and post-combustion emission systems. *Standard* *Performance rating of 3 on each criteria* *Assessment Tool* *Report Assessment Form, MEC REP 2*	15

MODULE MEC207: EMISSION CONTROLS (continued)

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• know the effects of vehicle pollutants on the environment	• observed performance based on: – discussion about exhaust emissions and their effect on the environment – listing the major exhaust emissions – knowledge of company exhaust emission levels, which are regulated in California and Canada – company emission produced by gasoline and alternate fuels. *Assessment Tool* *Report Assessment Form, MEC REP 2* *Standard* *Performance rating of 3 on each criteria*	15
• identify components that control emissions	• observed performance based on: – locating and identifying components on a vehicle – describing how components work together to reduce emissions – finding where missing components have been removed from a vehicle. *Assessment Tool* *Task Assessment Checklist, MEC TSK 4* *Standard* *Performance rating of 3 on each criteria*	25
• check and service emission control system	• evaluated performance based on: – connection of a gas analyzer to a vehicle – reading and recording the exhaust emissions – company recorded emission to manufacturers specification and analyze how well emission system functions. *Assessment Tool* *Task Assessment Checklist, MEC TSK 5* *Standard* *Performance rating of 3 on each criteria*	35
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal exploration during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

MODULE MEC207: EMISSION CONTROLS (continued)

Concept	Specific Learner Expectations	Notes
Safety and Environmental Concerns	*The student should:* • follow lab safety procedures. • describe effect of vehicle emissions on the environment.	
Pollutants	• list types and where vehicle pollutants are created • explain how these pollutants are created • research regulations that dictate maximum pollutant levels.	
Control Systems	• identify and understand the operation of the following pre-combustion control systems: – crankcase ventilation system – exhaust gas recirculation system – ignition spark control systems – computerized engine controls – evaporative control systems – engine design modifications; i.e., combustion chamber, piston, cylinder head, manifold and air induction design • identify and understand the operation of the following post-combustion control systems on several different types of vehicles: – air injection system – air aspirator system – catalytic converters	

MODULE MEC207: EMISSION CONTROLS (continued)

Concept	Specific Learner Expectations	Notes
• Servicing Emission Control Systems	*The student should:* • check and service positive crankcase ventilation system • check and service evaporative control system • check and service air injector system • check and service exhaust gas recirculation system • check catalytic converter • check and adjust spark control system • check computerized engine controls • using exhaust gas analyzer (if available), check emissions for a given vehicle.	As per manufacturer's specifications.

MODULE MEC209: ELECTRICAL COMPONENTS

Level: **Intermediate**

Theme: **Guidance and Control Systems**

Prerequisite: **Electrical Fundamentals (MEC109) recommended**

Module Parameters: Volmeter, Ohmmeter, ammeter, alternator, starter

Students become familiar with the basic use and testing of electrical components used in a typical motor vehicle.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• follow safety guidelines and standards when working with electrical components	• observed performance in demonstrating – avoidance of electrical conditions such as grounds, shorts, sparks – observing proper polarity – following shop electrical routines. *Assessment Tool* *Safety–Care Checklist, MEC SAF 1* *Standard* *Performance rating of 3 on each criteria*	10
• describe the function and operation of electrical system components	• report providing the following – list and function of vehicle electrical systems – list of electrical components in each system – operation of electrical systems. *Assessment Tool* *Report Assessment Form, MEC REP 2* *Standard* *Performance rating of 3 on each criteria*	15

MODULE MEC209: ELECTRICAL COMPONENTS (continued)

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• identify electrical faults through the use of standard diagnostic and testing procedures	• observed performance in: – use of voltmeter, ohmmeter and ammeter – testing for open and closed circuits – testing for load voltage and drop – testing for current draw – testing for resistances – recognizing abnormal electrical circuit conditions. *Assessment Tool* *Task Assessment Checklist, MEC TSK 4* *Standard* *Performance rating of 3 on each criteria*	25
• test and service electrical components	• observed performance in testing and overhaul of: – starter motor assembly – alternator assembly. *Assessment Tool* *Task Assessment Checklist, MEC TSK 4* *Standard* *Performance rating of 3 on each criteria*	50
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal exploration during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Safety and Environmental Concerns	*The student should:* • follow lab safety procedures.	

MODULE MEC209: ELECTRICAL COMPONENTS (continued)

Concept	Specific Learner Expectations	Notes
Electrical Systems: Construction and Operation	*The student should:* • locate the major electrical/electronic systems in a motor vehicle: lighting, charging and starting • explain the operation and function of each of the electrical/electronic systems • show how electrical/electronic systems interact with other vehicle systems; e.g., suspension and braking systems.	Draw block diagrams.
Electrical Components: Purpose and Identification	• for charging, starting and lighting systems, identify and explain the purpose and their basic component parts • recognize and draw the symbols for common electrical components • identify and describe the ratings that are given to electrical components; e.g., resistance, voltage, amperage and power rating.	
Electrical Testing and Diagnosis	• identify and describe the functions of a: – voltmeter – ohmmeter – ammeter – multimeter – load tester – tack dwell meter – growler • calibrate correctly, connect accurately and read the appropriate test equipment to determine: – open and closed circuit – load voltage and drop – current draw – component resistance.	
Electrical Service	• identify and correct faults associated with electrical components and instruments • overhaul a starter motor assembly • overhaul an alternator.	

MODULE MEC210: POWER ASSIST ACCESSORIES

Level: **Intermediate**

Theme: **Guidance and Control Systems**

Prerequisites: **Electrical Fundamentals (MEC109; recommended)**
Pneumatic and Hydraulic Systems (MEC111)

Module Parameters: **Multimeter, power accessories and related resources**

Instructional Qualification: Client work must be checked by certified technician

Students study and identify the functions and associated parts of power assist accessories.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• demonstrate established procedures of care and safety when working on power accessories	• observed performance based on: – personal care safety when working with power accessories – vehicle care and safety when working with power accessories – maintenance of a clean and organized workplace – safe and efficient use of tools and equipment *Assessment Tool* *Safety–Care Checklist, MEC SAF 1* *Standard* *Performance rating of 3 on each criteria*	15
• list components and state the function of power assist accessories	• performance as measured by: – a comprehensive list of available power assist accessories – demonstrating an understanding of power accessories that have been used to replace mechanical accessories showing how mechanical work can be performed by power assist accessories. *Assessment Tool* *Report Assessment Form, MEC REP 2* *Standard* *Performance rating of 3 on each criteria*	20

MODULE MEC210: POWER ASSIST ACCESSORIES (continued)

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• describe and test the major components of power accessories	• performance in describing and testing major power assist accessories: – descriptions of major components stating the type of energy used by the component and a measurement of the energy – description of the major components including mechanical and electrical principles. *Assessment Tool* *Task Assessment Checklist, MEC TSK 4* *Standard* *Performance rating of 3 on each criteria*	25
• repair or replace parts of power accessories which are found to be faulty	• observed performance related to: – following procedures to isolate and identify faulty components – effective and efficient removal and replacement of faulty power assist accessories – test to establish that the fault has been remedied – analysis of possible factors that caused the failure in the component – clean-up and reflect on the job. *Assessment Tool* *Task Assessment Checklist, MEC TSK 4* *Standard* *Performance rating of 3 on each criteria*	40
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal exploration during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

MODULE MEC210: POWER ASSIST ACCESSORIES (continued)

Concept	Specific Learner Expectations	Notes
Safety and Environmental Concerns	*The student should:* • demonstrate established lab safety procedure • follow practices that prevent damage to components.	
Types and Function	• describe the types and basic functions of power accessories found on vehicles • compare power accessories to the mechanical system they have replaced.	Steering, brakes, suspension, windows, door locks, antennae.
Parts Identification	• list the parts of selected power accessories • describe the function of the major parts of selected power accessories • trace the power path of selected power accessories.	
Diagnosis and Repair	• consult shop manuals for diagnostics pertaining to specific power accessories • identify problems and faults in power accessories systems.	
Futuristic Units	• evaluate current power accessories as a means of forecasting types of power accessories that may be used in future vehicles.	All services, diagnoses, repairs and replacements of parts must be checked by a licensed technician.

MODULE MEC211: BRAKING SYSTEMS

Level: **Intermediate**

Theme: **Guidance and Control Systems**

Prerequisite: **Pneumatic and Hydraulic Systems (MEC111)**

Module Parameters: **Access to specialized brake tools and related resources**

Instructional Qualification: Client work must be supervised by certified technician

Students develop the necessary knowledge, skills and attitudes to diagnose, service and maintain a braking system according to accepted trade practice.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• demonstrate safety procedures when working on brakes	• measured performance related to: – appropriate selection and use of protective supplies and equipment for personal safety – use of appropriate tools, materials, supplies and equipment for vehicle safety – safe practices when handling asbestos. *Assessment Tool* *Safety–Care Checklist, MEC SAF 1* *Standard* *Performance rating of 3 on each criteria*	10
• identify brake design and components, and state their application	• performance measured by: – identification and description of brake components – understanding of the application of braking components and their function. *Assessment Tool* *Report Assessment Form, MEC REP 2* *Standard* *Performance rating of 3 on each criteria*	15

MODULE MEC211: BRAKING SYSTEMS (continued)

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• identify and service a vehicle that is unsafe to drive when braking parts become worn or malfunction	• observed performance related to: – identification of vehicles with brake system components that are worn or have malfunctioned – understanding of factors that cause wear and/or malfunction – procedures to replace worn/malfunctioning brake parts on disc and drum brakes. *Assessment Tool* *Task Assessment Checklist, MEC TSK 4* *Standard* *Performance rating of 3 on each criteria*	50
• recognize the driving symptoms, as well as visual and instrument checks, that indicate worn or defective braking parts	• measured performance related to: – recognition of worn or defective brake parts – recognition of symptoms that indicate worn or defective brake parts – visual recognition of worn or defective brake parts – use of instruments that indicate worn or defective brake parts. *Assessment Tool* *Task Assessment Checklist, MEC TSK 4* *Standard* *Performance rating of 3 on each criteria*	15
• interpret parts and service manuals and perform routine braking system service and maintenance	• observed performance related to: – use of service manuals and parts manuals – application of information to the routine service of braking systems. *Assessment Tool* *Task Assessment Checklist, MEC TSK 4* *Standard* *Performance rating of 3 on each criteria*	10
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal exploration during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

MODULE MEC211: BRAKING SYSTEMS (continued)

Concept	Specific Learner Expectations	Notes
Safety and Environmental Concerns	*The student should:* • follow lab safety procedures.	Asbestos hazards. Brake fluid effect on painted surface.
Drum Brake Design	• identify the parts of a hydraulic brake drum system • compare the operating principles of duo-servo and non-servo brake systems • determine how brake drum and linings are checked for wear.	
Disc Brake Design	• identify the parts of a disc brake system • compare the operating principles of a fixed, floating and sliding caliper braking system • determine how brake pads and rotors are checked for wear • describe operation of a combined disc and drum system.	Valves involved.
Emergency Brake Design	• identify the parts of an emergency brake system • compare the operating principles of an emergency brake system on disc and drum brake applications.	
Customer Work/ Interview	• write up a work order , using appropriate questioning to determine brake problem.	
Preventive Maintenance	• check a master cylinder fluid level • inspect drum and disc brake linings for wear • adjust an emergency brake cable.	

Concept	Specific Learner Expectations	Notes
Brake Servicing	*The student should:* • machine a brake drum and rotor according to the manufacturer's specifications • remove and replace disc and drum brake shoes • remove and replace master cylinder, wheel cylinder and caliper • replace a flexible brake hose • bleed and flush a brake system.	Be familiar with internal components and rebuilding procedures.
Inspection	• on road-licensed vehicle, have final inspection done by certified personnel.	

MODULE MEC212: HYDRAULIC ACCESSORIES

Level: **Intermediate**

Theme: **Guidance and Control Systems**

Prerequisite: **Pneumatic and Hydraulic Systems (MEC111; recommended)**

Module Parameters: **Access to basic hand tools hydraulic systems and related resources**

Students develop a basic knowledge of hydraulic components, applications and servicing techniques.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• demonstrate safety procedures when working in hydraulic systems	• measured performance related to: – hazards associated with pressurized hydraulics – safe use of tools, equipment and materials – safe use of personal protective equipment – correct use of equipment used on vehicles. *Assessment Tool* *Safety–Care Checklist, MEC SAF 1* *Standard* *Performance rating of 3 on each criteria*	10
• develop a basic understanding of the function of hydraulic components in a hydraulic system	• observed performance related to: – the location and function of hydraulic components – use of parts and service manuals. *Assessment Tool* *Report Assessment Form, MEC REP 1* *Standard* *Performance rating of 3 on each criteria*	15
• interpret parts and service manuals to provide the appropriate maintenance and service procedures of a hydraulic system	• measured performance related to: – use of appropriate procedures and techniques on servicing hydraulic components. *Assessment Tool* *Task Assessment Checklist, MEC TSK 4* *Standard* *Performance rating of 3 on each criteria*	50

MODULE MEC212: HYDRAULIC ACCESSORIES (continued)

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• service hydraulic components	• given a hydraulic system, servicing individual componenets. *Assessment Tool* *Task Assessment Checklist, MEC TSK 4* *Standard* *Performance rating of 3 on each criteria*	25
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal exploration during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Safety and Environmental Concerns	*The student should:* • follow lab safety procedures.	
Hydraulic Fluids	• determine the properties of hydraulic fluids in relation to: – viscosity – lubricating ability – resistance to oxidation – corrosion prevention.	
Piping and Sealing	• identify the common types of connecting lines/hoses, fitting and seals.	
Reservoirs and Accessories	• describe the internal parts of a reservoir and state the purpose of filters, strainers and breathers.	
Actuators	• investigate the construction and operation of: – cylinder – gear and vane motors.	

MODULE MEC212: HYDRAULIC ACCESSORIES (continued)

Concept	Specific Learner Expectations	Notes
Controls	*The student should:* • determine the function of: – check and pressure control valves – two- and four-way valves.	
Pumps	• investigate the construction and operation of gear, vane and piston pumps.	
Accumulators	• determine why and when accumulators are used in a hydraulic system.	
Preventive Maintenance	• check fluid levels in reservoirs • check seals for leaks • clean strainers.	
Servicing	• replace system filters with the approved parts • change a seal on a cylinder • replace a defective hose line and fitting • replace the hydraulic fluid in a system.	

MODULE MEC213: POWER TRAINS

Level: **Intermediate**

Theme: **Guidance and Control Systems**

Prerequisite: **Mechanical Systems (MEC113; recommended)**

Module Parameters: **Access to, power train units, hand tools, specialized power train tools and related resources**

Students develop their understanding of the purpose, operation and servicing of a vehicle power train.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• demonstrate established safety procedures and care when working with vehicles	• observed performance related to: – safe practices using equipment, tools, materials and supplies – safe procedures when working with vehicle parts and components. *Assessment Tool* *Safety–Care Checklist, MEC SAF 1* *Standard* *Performance rating of 3 on each criteria*	10
• identify the purpose and describe the function of the major power train components	• measured performance related to: – identification of major power train components and their purpose – description and understanding of the inter-relationship between major components. *Assessment Tool* *Report Assessment Form, MEC REP 2* *Standard* *Performance rating of 3 on each criteria*	20

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• execute inspection, diagnostic, service and repair procedures on specific drive train components	• observed performance related to: – accurate inspection and diagnosis of power train components: clutch, manual transmission, drive axles/shaft, differential – service of power train components – repair and/or replacement of power train components. *Assessment Tool* *Task Assessment Checklist MEC TSK 4* *Standard* *Performance rating of 3 on each criteria*	50
• identify work-related opportunities in this specialized area of vehicle repair	• measured performance related to: – accurate and up-to-date information concerning opportunities in the area. *Assessment Tool* *Report Assessment Form, MEC REP 2* *Standard* *Performance rating of at least 2 on each criteria*	20
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal exploration during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Safety and Environmental Concerns	*The student should:* • follow lab safety procedures.	

Concept	Specific Learner Expectations	Notes
Purpose of the Power Train and the Requisite Component Assemblies	*The student should:* • state the overall purpose of the power transmission system in a vehicle relating it to top speed, torque, economy and weight or load • name the component assemblies of a power train on a given vehicle and describe the contribution each makes to the identified purpose.	
Types of Power Trains	• differentiate between the following power trains: – front wheel drive – rear wheel drive – four wheel drive • front–rear • rear–front – all wheel drive.	
Servicing the Power Train Components	• Automatic Transmission or Transaxle • review checking fluid levels • using a service scheduling publication, determine the fluid change interval and type • service an automatic transmission by replacing the fluid, filter and oil pan gasket • check an assembly for leakage and replace the required seal(s) if possible, or recommend the repair requirement	

Concept	Specific Learner Expectations	Notes
	The student should:	
• Manual Transmission or Transaxle/ Clutch	• check and adjust clutch linkage for correct free play or check operation of automatic adjuster if so equipped	
	• assess clutch serviceability	
	• determine the required fluid types as well as the fluid changing interval, using a service publication	
	• check the gear box fluid level and replenish or replace as necessary, considering the service requirement characteristics of the vehicle	
	• check the assembly for leaks and replace the required seal(s) if possible, or recommend the repair requirement	
	• adjust shifting linkages	
• Drive Shafts and Drive Axles	• inspect the drive shaft or drive axles for repair requirements such as: – worn U-joints or CV joints – broken grease seals/straps – structural damage	
	• repair the coupling joint or shaft as required to return it to serviceability according to manufacturer's specifications	
• Transfer Case	• inspect the fluid level and replenish or replace as required by service schedule	
	• check linkage operation and adjust or repair as required to ensure serviceability	
	• assess the operation of the assembly and repair, or recommend repair requirement	
	• inspect the assembly for leaks and replace the required seal(s), or recommend the repair requirement	
• Viscous Couplings	• locate and inspect the couplings if the vehicle is so equipped	
	• repair or recommend the required repair	

Concept	Specific Learner Expectations	Notes
• Differential	*The student should:* • check the fluid and either replenish or replace as necessary, considering the vehicle's operating conditions and service interval scheduling specifications • remove a differential cover and identify the parts enclosed, or if not an integral type of differential, remove the carrier assembly identifying the parts • inspect the housing for filings and inspect gears and bearings for wear and repair needs • calculate the gear ratio between the crown and pinion gears and determine the torque multiplication that results • reassemble and check assembly for leaks, replacing the required seals or recommending repair required.	
Noise and Vibration	• inspect the power transmission system components for alignment and wear as indicated by looseness • using a mechanics stethoscope, test the assemblies for noise at bearing locations while the system is being operated • determine the cause of noise or vibration and repair or recommend required repair • inspect isolation mounts and bushings at the power train assemblies to assess capability of noise or vibration transference.	
Career Awareness	• identify local businesses specializing in driveline repairs, and determine the work opportunities and potential earnings.	

MODULE MEC214: MANUAL TRANSMISSIONS AND TRANSAXLES

Level: **Intermediate**

Theme: **Guidance and Control Systems**

Prerequisite: **Power Trains (MEC213; recommended)**

Module Parameters: **Access to pilot shafts, specialized manual transmission tools, presses, pullers related resources and clutch, transmission and transaxle units**

Students perform inspection service and repair procedures on manual transmissions, transaxles and clutch assemblies.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• demonstrate established measures of safety and care when working with vehicles	• observed performance related to: – safe use of equipment, tools, materials and supplies – proper use of personal safety equipment – correct use of vehicle protective equipment – lifting components to avoid back injuries. *Assessment Tool* *Safety–Care Checklist, MEC SAF 1* *Standard* *Performance rating of 3 on each criteria*	15
• identify the parts and trace the power flow through a clutch, manual transmission and differential and manual transaxle assembly	• measured performance related to: – identification of the parts of the power train in a manual transmission and a manual transaxle – understanding the flow of power through a manual transmission and transaxle *Assessment Tool* *Report Assessment Form, MEC REP 2* *Standard* *Performance rating of 3 on each criteria*	30

MODULE MEC214: MANUAL TRANSMISSIONS AND TRANSAXLES (continued)

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• execute inspection, diagnostic, service and repair procedures on clutch, manual transmission or manual transaxle assembly	• observed performance related to: – inspection of a manual power train – diagnosis of problems of a manual power train – service of a manual power train – repair or replacement to a manual power train. *Assessment Tool* *Task Assessment Checklist, MEC TSK 4* *Standard* *Performance rating of 3 on each criteria*	50
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal exploration during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
Safety and Environmental Concerns	• follow lab safety procedures.	WHMIS, asbestos caution.
Clutch and Manual Gearbox Operation	• describe the operation of a clutch assembly, a manual transmission and a manual transaxle during various modes of vehicle operation • indicate the relationship that the clutch and manual gear box have to other parts of the power train • identify the parts of the assemblies, using the proper technical terms.	
Power Routing	• for each gear, determine the path of power through transmission or transaxle and compare the gear ratio of each power routing as well as the directional rotation.	

Concept	Specific Learner Expectations	Notes
Inspection	*The student should:*	
• Clutch	• check clutch pedal operation travel and free play adjustment • with assistance, test to identify any operating faults • remove the inspection cover and check for wear to the clutch disc and pressure plate, as well as other visually available parts • inspect linkage for faults and/or wear	Teamwork.
• Transmission/ Transaxle	• shift through the complete pattern to ensure linkage operation • inspect linkage for any undue looseness or signs of wear • check lubricant for level, type and recommended change interval • inspect mounts, braces and isolator cushions for wear fatigue or damage • inspect the assembly for leakage and note location and seal at fault.	
Problem Diagnosis		
• Clutch	• formulate probable causes for typical problems that develop with clutches: – grabbing – slipping – failing to release – noise when disengaged – noise when engaging • where possible, relate the hypothetical situation to a real vehicle condition	Where possible, relate the hypothetical situation to a real vehicle condition.

Concept	Specific Learner Expectations	Notes
	The student should:	
• Transmissions/ Transaxles	• formulate probable causes for typical problems that develop with manual gear boxes: – gears clashing – hard shifting – jumps out of gear – noises in specific gears – unable to engage gears – shifter noisy or loose – bearing noises	Where possible, relate the hypothetical situation to a real vehicle condition.
• Clutch Maintenance	• adjust linkage for correct free play at pedal or, in the case of an automatic clutch adjuster, confirm the operation as being correct	
• Transmission/ Transaxle Maintenance	• drain the lubricant and renew with type specified.	As per manufacturer's recommendations.
Repair Estimate	• prepare a repair cost estimate, prior to commencement of repairs, as identified during inspection or servicing.	
Clutch Repair	• follow through on agreed-upon repairs, identified and estimated to the teacher and the owner of the vehicle and/or • remove and reinstall a clutch disc, pressure plate assembly, pilot bearing and throw-out bearing; check each part to confirm the continued serviceability of the assembly and clean each part before reassembly. Adjust linkage to specified clearances.	Does not imply a complete overhaul (refer to MEC313).

Concept	Specific Learner Expectations	Notes
Transmission/ Transaxle Repairs	*The student should:* • follow through on agreed-upon repairs, identified and estimated to the teacher and the owner of the vehicle and/or • disassemble, thoroughly inspect and reassemble a model transmission of three or four speeds with external linkage and constant mesh gearing.	Does not imply a complete overhaul (refer to MEC313).

MODULE MEC215: SUSPENSION SYSTEMS

Level: **Intermediate**

Theme: **Suspension and Structural Systems**

Prerequisite: **Ride and Control Systems (MEC115)**

Module Parameters: **Access to suspension systems, specialized suspension tools and related resources**

Instructional Qualification: Client work must be checked by certified technician

Students develop the knowledge, skills and attitudes needed to service and maintain vehicle suspension systems.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• demonstrate safety procedures when working on suspension systems	• observed performance related to: – safe use of equipment, tools, materials, and supplies when working on suspension systems – personal use of safety apparel – use of safety materials to protect vehicle against damage. *Assessment Tool* *Safet–Care Assessment Checklist, MEC SAF 1* *Standard* *Performance rating of 2 on each criteria*	15
• identify a vehicle that is unsafe to drive owing to defective suspension parts	• observed performance related to: – recognition of suspension parts – determining worn and malfunctioning parts – assessing vehicle safety. *Assessment Tool* *Task Assessment, Checklist MEC TSK 4* *Standard* *Performance rating of 3 on each criteria*	15

MODULE MEC215: SUSPENSION SYSTEMS (continued)

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• recognize symptoms that indicate worn or defective suspension parts	• observed performance measured by: – identification of worn and defective suspension parts – analysis of symptoms related to worn and/or defective suspension parts – systematic troubleshooting to determine driveability problems caused by worn/defective suspension parts. *Assessment Tool* *Task Assessment Checklist, MEC TSK 4* *Standard* *Performance rating of 3 on each criteria*	25
• service a suspension system	• observed performance related to: – accurate and proper service of a suspension system – use of tools/materials/equipment – procedures outlined in service manuals or shop materials supplied. *Assessment Tool* *Task Assessment Checklist, MEC TSK 4* *Standard* *Performance rating of 3 on each criteria*	45
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal exploration during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Safety and Environmental Concerns	*The student should:* • follow lab safety procedures when working on suspensions.	

MODULE MEC215: SUSPENSION SYSTEMS (continued)

Concept	Specific Learner Expectations	Notes
Suspension Designs	*The student should:* • describe the basic types of front and rear suspensions used on motor vehicles; e.g., short, long arm suspension and MacPherson strut • compare the advantages and disadvantages of using separate and integral frames in relation to suspension design, repair and servicing • explain the advantage of using a: – solid "I" beam – split "I" beam – independent front suspension and a: • rigid • independent rear suspension • determine why it is important to reduce the amount of unsprung weight.	
Spring Types	• list the positive and negative features of using coil, leaf, torsion, rubber biscuit and air springs • explain the meaning of spring rate and travel.	
Shock Absorbers	• describe the basic types and operation of shock absorbers, mounting techniques and methods of testing • explain how shock absorber ratio is calculated.	Gas shocks.
Wheel Bearings	• examine a typical wheel bearing for faults; e.g., bent cage, etching, overheating and worn seal.	
Preventive Maintenance	• repack a front or rear wheel bearing • lubricate suspension joints where necessary.	
Suspension Components	• inspect suspension components for damage and wear • determine how both frictional and weight carrying ball joints are checked for wear.	

Concept	Specific Learner Expectations	Notes
Servicing	*The student should:* • remove and replace according to approved safe practice: – a shock absorber – a coil spring – a ball joint – a strut.	
Advanced Suspension Systems	• indicate the appropriate lifting and towing procedures relative to electronically controlled suspension systems.	
Inspection	• on road-licensed vehicle, have final inspection done by certified personnel.	

MODULE MEC216: STEERING SYSTEMS

Level: **Intermediate**

Theme: **Suspension and Structural Systems**

Prerequisite: **Ride and Control Systems (MEC115)**

Module Parameters: Access to steering systems, specialized steering tools and related resources

Instructional Qualification: Client work must be checked by certified technician

Students develop the knowledge, skills and attitudes necessary to maintain a steering system.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• demonstrate safe practices when working on steering systems	• observed performance related to: – personal safety and specific vehicle safety when working on steering components – safe use and care of equipment, tools, materials and vehicle parts. *Assessment Tool* *Safety-Care Checklist, MEC SAF 1* *Standard* *Performance rating of 2 on each criteria*	10
• identify different steering system design and application	• measured performance related to: – identification of three or more common steering designs and applications – understanding of the advantages and limitations of steering designs – knowledge of the evolution of steering designs. *Assessment Tool* *Report Assessment Form, MEC REP 2* *Standard* *Performance rating of 2 on each criteria*	15–20

MODULE MEC216: STEERING SYSTEMS (continued)

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• identify and service/ repair vehicle steering system	• observed performance related to: – identification of the types of steering systems and their components – procedures followed during service and repair to steering systems – retrieval and use of specifications and measurements in servicing and repairing steering systems *Standard* *Performance rating of 2 on each criteria* *Assessment Tool* *Task Assessment Checklist*	35–40
• recognize the driving symptoms, visual and instrument checks, which indicate worn or defective steering parts	• observed performance related to: – recognition of driving symptoms and their connection to worn/defective steering parts – evaluation of specifications and measurements to locate worn/defective parts – analysis of parts to determine cause of wear and/or malfunction of steering parts *Standard* *Performance rating of 2 on each criteria* *Assessment Tool* *Task Assessment Checklist*	30–40
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal exploration during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Steering System Designs	*The student should:* • identify common types of steering gear used to create the necessary mechanical advantages to overcome tire resistance; e.g.: – worn and sector – Ross cam and lever – recirculating ball – rack and pinion • examine and compare the operation of two or more steering gear boxes • describe the steering linkage used with rack and pinion and recirculating ball type systems • examine the construction of a tie rod assembly and explain how it is built to accommodate up and down as well as lateral movement.	
Advanced Steering Systems	• explain the operation of four wheel steering and outline the advantages of this type of steering over a conventional two wheel system.	
Preventive Maintenance	• complete a work order form • check and adjust power steering fluid level • check the lubricant level in a manual steering gear and add the appropriate lubricant if necessary • lubricate steering parts.	
Servicing	• adjust a manual steering gear • clean and inspect steering linkage for wear and replace if necessary • inspect steering joints, bushings and replace if necessary • inspect and service rack and pinion steering gear • inspect and service power steering components.	
Inspection	• on road-licensed vehicle, have final inspection done by certified personnel.	

MODULE MEC217: METAL REPAIR AND FINISHING

Level: **Intermediate**

Theme: **Suspension and Structural Systems**

Prerequisite: **Metal Forming and Finishing (MEC117; recommended)**

Module Parameters: **Access to MIG and gas welder, basic body hand/power tools and related resources**

Students repair major sheet metal damage.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student achievement will be based on:*	
• demonstrate safe practices when metal forming and finishing on major sheet metal damage	• observed performance related to: – following safe practices and use of proper tools – following instructions as given. *Assessment Tool* *Safety–Care Checklist, MEC SAF 1* *Standard* *Performance rating of 3 on each criteria*	10
• identify different damage condition and repair procedures for major sheet metal damage	• use of appropriate resources to produce a report describing: – direct damage – indirect damage – buckles – forces created by collision. *Assessment Tool* *Report Assessment Form, MEC REP 2.* *Standard* *Performance rating of 3 on each criteria*	25

MODULE MEC217: METAL REPAIR AND FINISHING (continued)

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• repair major sheet metal damage	• observed performance related to: – ability to solve problem of repair – proper sequence of repair – correct use of metal, welding and finishing – final outcome of repair. *Assessment Tool* *Task Assessment Checklist, MEC TSK 4* *Standard* *Performance rating of 3 on each criteria*	65
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal exploration during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Safety and Environmental Concerns	*The student should:* • demonstrate safe practices in relation to: – use of welding equipment – use of solder – sheet metal straightening system.	Hydraulic pulling equipment; come-along.
Damage Analysis	• determine type/extent of damage • list sequence of repair.	
Major Sheet Metal Damage	• analyze impact damage conditions: – direct damage – indirect damage • determine sequence of repair.	Non-structural. Work hardening, tears, gouges, buckles, pressure forces. Aluminum versus ferrous sheet metal.

MODULE MEC217: METAL REPAIR AND FINISHING (continued)

Concept	Specific Learner Expectations	Notes
Damage Repair	*The student should:* • perform metal straightening • perform metal working • investigate/repair damaged aluminum panel • investigate/repair using body solder.	May only be an investigation/ demonstration.
Large Rust Out Repair	• describe possible methods of repair • determine the best method of repair • complete the repair.	Partial or complete panel.

MODULE MEC218 : TRIM REMOVAL AND INSTALLATION

Level: **Advanced**

Theme: **Suspension and Structural Systems**

Prerequisite: **Interior Finishes and Repairs (MEC222; recommended)**

Module Parameters: **Access to specialized trim tools and related resources**

Students explore the value, care, removal and repair of trim parts. Emphasis is on removal and installation without damage.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• investigate interior and exterior trim systems used to enhance appearances	• presentation of a report describing: – interior/exterior trim materials, plastic, vinyl, cloth, leather, moldings and decals – functions of window and door lock parts using various diagrams – fasteners unique to interior/exterior. *Assessment Tool* *Report Assessment Form, MEC REP 2* *Standard* *Performance rating of 3 on each criteria*	15
• demonstrate care and patience in procedures required for removal and installation of trim and weather-stripping	• observed performance related to: – interior door trim removal and installation – exterior trim removal and installation – use of proper tools. *Assessment Tool* *Task Assessment Checklist, MEC TSK 4* *Standard* *Performance rating of 3 on each criteria*	50

MODULE MEC218: TRIM REMOVAL AND INSTALLATION (continued)

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• develop knowledge of trim principles	• observed performance related to: – problem solving trim removal, given a new situation – application of trim. *Assessment Tool* *Task Assessment Checklist, MEC TSK 4* *Standard* *Performance rating of 2 on each criteria*	25
• explore career opportunities and further education	• presentation of a report on alternative career choices: – glass installation/removal – trim installation – accessory centres. *Assessment Tool* *Report Assessment Form, MEC REP 2* *Standard* *Performance rating of 3 on each criteria*	20
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal exploration during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Interior Trim	*The student should:* • identify the materials used for interior trim, the fastening system for each and describe the correct method of removal • explore the methods to remove and install interior trim • describe precautions to be adhered to when removing and installing trim	

MODULE MEC218: TRIM REMOVAL AND INSTALLATION (continued)

Concept	Specific Learner Expectations	Notes
	The student should: • describe principles of trim accessories, door locks, mirrors, etc. • remove and replace specified trim.	
Exterior Trim	• identify fasteners specific to exterior trim, including clips and adhesives • practise correct procedures and tools used in the removal of moldings, emblems and accessories • explain the inherent value of decals, vinyl and overlays • describe procedures for removal of decals, vinyl and overlays • install selected trim.	
Weather Stripping	• determine the function of weather-stripping • successfully remove and install a door seal, test seal and adjust hardware accordingly • identify two or three different methods of weather-stripping and explain the significance of the differences.	
Accessories	• service accessories considered to be trim; e.g., locks, mirrors, lights • identify two or three procedures needed to remove accessories and implications for repair or replacement.	

MODULE MEC219: SURFACE PREPARATION II

Level: **Intermediate**

Theme: **Suspension and Structural Systems**

Prerequisite: **Surface Preparation I (MEC119; recommended)**

Module Parameters: **Access to auto body hand/power tools related resources**

Students perform advanced surface preparation.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student achievement will be based on:*	
• demonstrate safe practices when doing advanced surface preparation	• observed performance related to: – following safe practices and use of proper personal protective equipment – following shop routines. *Assessment Tool* *Safety–Care Checklist, MEC SAF 1* *Standard* *Performance rating of 3 on each criteria*	10
• have knowledge of materials and practices in performing advanced surface preparation	• observed performance in: – metal identification and treatment – plastic preparation and priming – proper use of abrasives. *Assessment Tool* *Task Assessment Checklist, MEC TSK 4* *Standard* *Performance rating of 3 on each criteria*	40
• do an advanced surface preparation	• observed performance related to: – proper use of chemical – sequence of application of coatings – problem solving a repair. *Assessment Tool* *Task Assessment Checklist, MEC TSK 4* *Standard* *Performance rating of 3 on each criteria*	50

MODULE MEC219: SURFACE PREPARATION II (continued)

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will: • demonstrate effort to develop basic competencies.	*Assessment of student assessment will be based on:* • observations of individual effort and interpersonal exploration during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Safety and Environmental Concerns	*The student should:* • demonstrate safe practices in relation to chemicals.	WHMIS; check with supplier for handling procedures.
Bare Metal Treatment	• identify specific metal treatments, such as: – aluminum – plymetal – galvanized – other • analyze and prepare bare metal.	Aluminum; plymetal; galvanized; new anodized aluminum. Prepare metal replacement parts.
Surface Rust Repair	• clean and treat as conditions dictate.	Spot blasting; sanding; chemical treatment.
Compounding	• identify equipment, materials and accepted procedures in compounding surfaces • compound surfaces.	Spot repair; adjacent panel matching.
Preparation of Plastic Parts	• match adhesion promoters to type of plastic being finished • use correct cleaning agent to match plastics and product used • prime plastic parts.	Flexible plastic; rigid plastic; interior/exterior plastics; cleaners. Flexible filling primer; special adhesion promoters.
Specialty Masking	• recognize the possibility of custom masking • custom mask a small project.	Flames; elaborate striping.

MODULE MEC220: REFINISHING I

Level: **Intermediate**

Theme: **Suspension and Structural Systems**

Prerequisite: **Surface Preparation II (MEC219; recommended)**

Module Parameters: **Access to spray equipment and related resources**

Students demonstrate metal surface refinishing procedures.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student achievement will be based on:*	
• demonstrate safe practices and follow all warnings identified by manufacturer and Occupational Health and Safety	• observed performance related to: – health hazards involved in refinishing – warnings as outlined in WHMIS bulletins – following proper personal and shop safety routines. *Assessment Tool* *Safety–Care Checklist, MEC SAF 1* *Standard* *Performance rating of 3 on each criteria*	15
• know refinishing products and equipment	• presentation of a report identifying and describing: – paint spray systems (two) – paint spray techniques – problems created by improper techniques and equipment. *Assessment Tool* *Report Assessment Form, MEC REP 2* *Standard* *Performance rating of 3 on each criteria*	30

MODULE MEC220: REFINISHING I (continued)

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• demonstrate proper refinishing application	• observed performance related to: – proper use of paint products (paint reducer/ hardener) – following demonstrated spray techniques – following proper spray procedures – proper care of spray equipment. *Assessment Tool* *Task Assessment Checklist, MEC TSK 4* *Standard* *Performance rating of 3 on each criteria*	55
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal exploration during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Safety and Environmental Concerns	*The student should:* • know health hazards and environmental impacts of products used • demonstrate use of personal protective equipment as recommended by manufacturer.	WHMIS; product information. MSDS Sheets available. Respirators; glove, coveralls.
Top Coats	• identify types of top coats, solvents and additives • identify and select colour and type of paint on a given vehicle • understand procedure in paint preparation.	Mixing measurements; additive, solvents; agitation.
Pre-paint Preparation	• inspect project and determine deficiencies • prepare booth for spraying.	Masking, surface preparation to acceptable standards. Cleanliness; anti-static systems.

MODULE MEC220: REFINISHING I (continued)

Concept	Specific Learner Expectations	Notes
Spray Gun Techniques	*The student should:* • understand proper top coat application techniques • perform basic application problem troubleshooting • prepare and apply top coat.	Dry spray; runs, etc.
Basic Refinishing Equipment	• identify basic spray gun types • spray gun troubleshoot • understand and perform cleaning of spray guns • be knowledgeable of refinishing equipment accessories.	Suction feed; gravity feed; pressure pot, HVLP. Size and type of air lines; air cleaning and control devices.
Pre-delivery Vehicle Preparation	• perform final detailing: – removal of masking/tape – check and correct surface defects – final cleaning and inspection.	Polishing if required.

MODULE MEC221: BASIC TOUCH-UP AND FINISHING

Level: **Intermediate**

Theme: **Suspension and Structural Systems**

Prerequisite: **Vehicle Structures and Materials (MEC116; recommended)**

Module Parameters: **Access to spray equipment and related resources**

Students determine and use the appropriate materials, tools and processes to make minor surface repairs.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• practise the safe handling, use and disposal of hazardous touch-up and finishing products	• observed performance related to: – safe handling of refinish products – proper use of refinish tools and equipment – following correct safety routines in disposal and clean-up of hazardous materials. *Assessment Tool* *Safety–Care Checklist, MEC SAF 1* *Standard* *Performance rating of 3 on each criteria*	15
• analyze the extent of damage and identify the techniques and products required to complete a minor surface repair	• given a repair problem demonstrate: – problem-solving ability – knowledge of repair procedures and products – proper use of primers, putties and cleaners. *Assessment Tool* *Problem-solving Assessment Tool, MEC PRO 5* *Standard* *Performance rating of 3 on each criteria*	40

MODULE MEC221: BASIC TOUCH-UP AND FINISHING (continued)

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• demonstrate the skills required to prepare and refinish a spot repair	• observed performance related to: – following proper repair sequence in a spot repair – selection of paint by code – matching of colour as required – application of paint using proper techniques and skills – recognizing metallic colour-matching problem. *Assessment Tool* *Task Assessment Checklist, MEC TSK 4* *Standard* *Performance rating of 3 on each criteria*	45
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal exploration during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Safety and Environmental Concerns	*The student should:* • research and review the safety precautions required for: – feather edging with D/A sanders – handling of primer products and putties – spraying primers.	
Surface Flaws	• identify the imperfections in paint or freshly prepared surfaces; e.g., sand scratches, runs, dry spray, orange peel, "bulls eye", sags, chips • perform a surface repair of a painted panel, using sandpaper and compounds without repainting.	

MODULE MEC221: BASIC TOUCH-UP AND FINISHING (continued)

Concept	Specific Learner Expectations	Notes
Primers and Putties	*The student should:* • prepare a panel for a spot repair and follow appropriate instructions in application of primer and paint • show proper procedure in the application and sanding of putties.	
Spot Repair	• learn the spot repair concepts as required by industry including colour matching concepts of two types of paint: – solids – metallics • research the advantages of the base/clear system of paint in colour matching.	
Career Exploration	• explore further education and work opportunities related to touch-up and repair.	Chip repair and air brush use.

MODULE MEC222: INTERIOR FINISHES AND REPAIRS

Level: **Intermediate**

Theme: **Suspension and Structural Systems**

Prerequisite: **Vehicle Structures and Materials (MEC116; recommended)**

Module Parameters: **Access to interior materials, products, tools, equipment and related resources**

Students search for and use the appropriate products and techniques to maintain vehicle interior surface materials.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• practise the safe handling, use and disposal of hazardous cleaning and repair products	• observed performance related to: – proper handling of volatile chemicals – proper disposal of environmentally unfriendly chemicals – following procedures necessary for protection of vehicle and persons. *Assessment Tool* *Safety–Care Checklist, MEC SAF 1* *Standard* *Performance rating of 3 on each criteria*	20
• analyze the type of repair or restoration and identify the techniques and products required to repair and/or restore an interior surface	• given samples of interior material: – identify and describe usage – describe proper care with products and procedures – relate common stains, spots and soils to methods needed for removal. *Assessment Tool* *Report Assessment Form, MEC REP 2* *Standard* *Performance rating of 2 on each criteria*	35

MODULE MEC222: INTERIOR FINISHES AND REPAIRS (continued)

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• demonstrate the skills required to clean and/or repair an interior surface or seal	• observed performance in completion of an interior clean and repair: – using problem-solving techniques to identify proper procedures – using appropriate material to complete a simple repair – following shop routines required. *Assessment Tool* *Problem-solving Assessment Tool, MEC PRO 5* *Standard* *Performance rating of 3 on each criteria*	45
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal exploration during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Safety and Environmental Concerns	*The student should:* • follow safety rules and procedures for the products used for interior care • identify hazards associated with the improper use of certain volatile chemicals.	

MODULE MEC222: INTERIOR FINISHES AND REPAIRS (continued)

Concept	Specific Learner Expectations	Notes
Cleaners and Materials	*The student should:* • identify cleaners for the following materials: – leather – cloth – vinyl – rubber – plastic – polyurethane foam • research the correct procedures and products that can safely be used for cleaning and maintenance, including volatile cleaners, neutral soaps and specialty products • compile an identification of interior parts and clean the parts to like-new condition or "best as can be expected", depending on condition. Include glass in the cleaning.	Non-silicon products.
Stains, Soils and Spots	• examine and identify the nature of stains: soil, grease, oil, tar, blood, wax, chocolate and non-chocolate candy • identify correct procedures for removal of three of the above • compile a chart showing the stain removal procedures, including special products, if required.	
Simple Repair	• replace the vinyl or cloth covering on a door rest • complete a vinyl or plastic repair of a crack or hole in an interior part • successfully remove and replace weather stripping in either a door glass area or door opening • identify signs of poor sealing by weather stripping and adjust if possible.	
Career Exploration	• explore further education and career opportunities related to interior finishes and repairs.	

MODULE CURRICULUM AND ASSESSMENT STANDARDS

ADVANCED LEVEL

The following pages define the curriculum and assessment standards for the advanced level of Mechanics.

Advanced level modules demand a higher level of expertise and help prepare students for entry into the workplace or a related post-secondary program.

Module MEC301: Buying and Selling a Vehicle F.3
Module MEC302: Vehicle Value Appraisal F.7
Module MEC303: Engine Performance Diagnosis F.11
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Module MEC305: Engine Removal and Installation F.19
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MODULE MEC301: BUYING AND SELLING A VEHICLE

Level: **Advanced**

Theme: **Vehicle Design and Ownership**

Prerequisite: **None**

Module Parameters: **Access to related resources**

Students develop the skills required to make an informed purchase or sale of a vehicle.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• investigate and determine the type of vehicle that best meets his or her needs	• a report indicating: – reasons why a particular type of vehicle was selected – how this vehicle will meet determined uses, financial constraints, emotional appeal. *Assessment Tool* *To be developed* *Standard* *To be developed*	15
• evaluate a vehicle in relationship to its condition and suitability	• inspection and comparison of selected vehicle to predetermined constraints *Assessment Tool* *To be developed* *Standard* *To be developed*	35
• plan a strategy to sell or buy a vehicle	• thoroughness of report generated on selected plan, indicated: – outlining steps in selling or buying a vehicle – determining the value of the vehicle – advertising for or promoting a vehicle. *Assessment Tool* *To be developed* *Standard* *To be developed*	25

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• recognize the legal rights and responsibilities of both the seller and purchaser	• investigation of legal implications/obligations involved in: – buying a vehicle – selling a vehicle. *Assessment Tool* *To be developed* *Standard* *To be developed*	15
• identify safety concerns when dealing with unfamiliar vehicles	• identification of safety related concerns when: – buying a vehicle – selling a vehicle *Assessment Tool* *To be developed* *Standard* *To be developed*	10
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal interaction during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Safety and Environmental Concerns	*The student should:* • identify safety concerns when dealing with unfamiliar vehicles.	
Buying a Vehicle: • Choosing a Vehicle	• identify his or her choice of a vehicle on such factors as: – intended use and length of service – required performance and economy – funds or financing available – emotional appeal – consumer reports	

MODULE MEC301: BUYING AND SELLING A VEHICLE (continued)

Concept	Specific Learner Expectations	Notes
	The student should:	
• Shopping for a Vehicle	• describe the advantages and disadvantages of purchasing a vehicle: – privately – by auction – through dealers – lease agencies – rental agencies – government agencies	
• Vehicle Inspection	• determine the parts of a vehicle that can be inspected by: – visual means – road testing – instrument checks	Engine, brakes, steering, body.
• Making an Offer	• make an offer to purchase considering the following: – condition and age of the vehicle – dealer cost – profit level – value of trade in – cost of financing – ability to pay or make payment – possible liens	Observing contract/ bill of sale. Legal obligations.
• Who to Buy From	• select or recommend a seller based on: – the seller's reputation – ability to service – willingness to back the product – number of vehicles to choose from.	
Selling a Vehicle		
• Getting It Ready	• organize and prepare a record of the vehicle's service and maintenance record • prepare the vehicle so that it looks as close to new as possible	Could be combined with MEC102 and MEC201.

Concept	Specific Learner Expectations	Notes
• Determining the Value of a Vehicle • Advertising and Promoting the Sale of a Vehicle	*The student should:* • determine the value of a vehicle by: – having it appraised by more than one individual – comparing the appraisal to the Blue Book price – calculating the value through depreciation – comparing the asking price of similar vehicles • explore the advantages of selling a vehicle: – on consignment – privately – on a trade.	Information from car dealer. Used car sales person as resource.
Career Opportunities	• investigate career opportunities related to: – vehicle sales – appraisals – financing.	

MODULE MEC302: VEHICLE VALUE APPRAISAL

Level: Advanced

Theme: Vehicle Design and Ownership

Prerequisites: Vehicle Maintenance (MEC202)
Buying and Selling a Vehicle (MEC301; recommended)

Module Parameters: Access to related resources

Students develop an understanding of the use of industry standard references to arrive at an estimation of the cost of a mechanical repair and the market value of a vehicle.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• demonstrate established procedures of safety and care when inspecting vehicles	• observed performance in: – following established shop/lab procedures – safety and care as related to inspections. *Assessment Tool* *To be developed* *Standard* *To be developed*	10
• inspect a vehicle to determine repair requirements and assess the overall vehicle condition	• inspection performance in: – covering all systems – judgment in required service/repair. *Assessment Tool* *To be developed* *Standard* *To be developed*	35
• apply accepted industry standard references to problems of estimation and appraisal	• generated report indicated problems of estimating appraising within industry dictated standards. *Assessment Tool* *To be developed* *Standard* *To be developed*	15

MODULE MEC302: VEHICLE VALUE APPRAISAL (continued)

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• demonstrate the ability to complete a repair estimation to automobile industry standards and to prepare a vehicle market value estimate	• observed performance in: – completeness of report – inclusion of industry standards – matching true market value. *Assessment Tool* *To be developed* *Standard* *To be developed*	30
• outline the best business practices to follow when situations of uncertainty or conflicting interests occur relative to estimation and valuation	• outlining business practices to follow during problematic situations. *Assessment Tool* *To be developed* *Standard* *To be developed*	10
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal interaction during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Safety and Environmental Concerns	*The student should:* • follow predetermined shop guidelines when working on or around vehicles.	

Concept	Specific Learner Expectations	Notes
Vehicle Inspection	*The student should:* • investigate the condition of a vehicle using a comprehensive method, including owner interview and inspection report completion • examine the system(s) that require repair to determine the extent of reconditioning required to return the system(s) to serviceability • construct a basis for vehicle valuation by determining the vehicle characteristics that would contribute to market value (e.g., year, make, model, options, mileage, relative condition, classic attractiveness) • complete an evaluation checklist.	
Repair Estimation	• develop a complete listing of probable and possible parts required to effect a complete repair OEM, aftermarket and used parts • using a accepted industry labour guide, determine the correct labour charges for the required parts replacements, considering all modifications or options to the subject vehicle.	Include the repair estimate of cost, any shop supply, taxes or other charges that would contribute to the total estimated price.
Vehicle Valuation	• establish the wholesale value of a subject vehicle using the accepted wholesale reference guides • determine the market value of a subject vehicle by comparative pricing on three similar vehicles in the local marketplace.	For example, Red Book, Black Book, Blue Book. Use Alberta Motor Association as resource. Explore linkages with auto industry. Use consumer guide.

Concept	Specific Learner Expectations	Notes
Repair Decision Making	*The student should:* • assess the wisdom of repairing a vehicle considering all factors affecting market resale evaluation • prepare an estimation/evaluation summary for presentation to a vehicle owner • determine the best course of completing the requested repairs ensuring the security of the business enterprise.	
Career Opportunities	• identify further education and work opportunities related to vehicle value appraisal.	

MODULE MEC303: ENGINE PERFORMANCE DIAGNOSIS

Level: **Advanced**

Theme: **Propulsion Systems**

Prerequisites: **Lubrication and Cooling Systems (MEC203)**
Fuel and Exhaust Systems (MEC204)
Ignition Systems (MEC206)
Emission Controls (MEC207)

Module Parameters: **Access to vehicle engine, diagnostic test equipment and related resources**

Students will learn to trouble-diagnose an engine for worn/damaged parts and/or improper adjustments.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• demonstrate safe practices while doing engine performance diagnosis	• observed performance in: – following safe lab practices – recognizing potential hazards during engine diagnosis. *Assessment Tool* *To be developed* *Standard* *To be developed*	10
• assess certain aspects of an engine by listening, touching and observing	• observed performance in demonstrating ability to diagnose engine problems by using: – sense of touch – sense of hearing. *Assessment Tool* *To be developed* *Standard* *To be developed*	25

MODULE MEC303: ENGINE PERFORMANCE DIAGNOSIS (continued)

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• assess engine conditions with specialized test equipment and on-board diagnostics	• observed performance in using equipment to determine the condition of the following, in a given engine: – ignition systems – fuel system – cooling/exhaust system – emission control – mechanical. *Assessment Tool* *To be developed* *Standard* *To be developed*	50
• provide a report on the condition of engines diagnosed	• report generated to reflect the true condition of a given engine. *Assessment Tool* *To be developed* *Standard* *To be developed*	15
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal interaction during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Safety and Environmental Concerns	*The student should:* • demonstrate safety while diagnosing engines.	
Problem Solving	• list possible engine problems based on information provided.	Owner complaints.

MODULE MEC303: ENGINE PERFORMANCE DIAGNOSIS (continued)

Concept	Specific Learner Expectations	Notes
Evaluating Without Test Equipment	*The student should:* • through listening, observing, touching a running and/or stopped engine, determine whether abnormalities exist.	For example,, noises, blow-by, oil leaks, loose connections/ parts, oil/coolant conditions, belts, hoses, filters.
Evaluating With Specialized Equipment	• analyze intake manifold vacuum • check ignition timing and advance mechanisms • check for proper idle speeds • check engine oil pressure • check cylinder compression readings • with an engine analyzer and/or computerized tester, determine the condition of various engine systems as per capability of the test unit • check exhaust emissions.	
On-board Diagnostics	• determine any abnormalities on the vehicle, using gauges and lights, including self-diagnostics.	
Analyzing Data	• compile all information and generate a report for the customer outlining defects found and recommended corrections.	Students generate their own format.
Career Opportunities	• identify further education and career opportunities related to engine performance and diagnosis.	

MODULE MEC304: ENGINE TUNE-UPS

Level: **Advanced**

Theme: **Propulsion Systems**

Prerequisites: **Lubrication and Cooling Systems (MEC203)**
Fuel and Exhaust Systems (MEC204)
Ignition Systems (MEC206)
Emission Controls (MEC207)
Electrical Components (MEC209)
Engine Performance Diagnosis (MEC303; recommended)

Module Parameters: **Access to engine diagnostic equipment and supporting resources**

Students diagnose, service and repair engine, fuel, ignition, charging and starting systems.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• demonstrate safe work habits while doing a tune-up	• observed performance in: – following shop/lab established procedures – recognizing and observing aspects that protect equipment and vehicle. *Assessment Tool* *To be developed* *Standard* *To be developed*	10
• determine engine mechanical condition	• observed performance in equipment procedural use and results obtained in determining mechanical condition. *Assessment Tool* *To be developed* *Standard* *To be developed*	15
• clean and adjust carburetor	• observed performance in cleaning and adjusting a single and two-barrel carburetor. *Assessment Tool* *To be developed* *Standard* *To be developed*	15

MODULE MEC304: ENGINE TUNE-UPS (continued)

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• clean and service fuel injectors	• observed performance in servicing fuel injectors. *Assessment Tool* *To be developed* *Standard* *To be developed*	10
• use diagnostic equipment to check ignition, charging and starting systems, and service as required	• observed performance in use of equipment to check ignition, charging and starting systems. *Assessment Tool* *To be developed* *Standard* *To be developed*	30
• interpret test results and service as required	• observed performance in interpreting and servicing systems. *Assessment Tool* *To be developed* *Standard* *To be developed*	20
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal interaction during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Safety and Environmental Concerns	*The student should:* • follow lab safety procedures.	
Engine Condition	• perform a static and dynamic compression test • do a leak down test • record and analyze results.	

MODULE MEC304: ENGINE TUNE-UPS (continued)

Concept	Specific Learner Expectations	Notes
Carburetor Fuel Systems (including filters)	*The student should:* • determine whether a carburetor problem exists and document specifics • remove, clean and adjust a carburetor • check and/or replace filters • test fuel pump pressure and capacity.	
Fuel Injection Systems	• determine whether a problem exists and document specifics • clean fuel injectors.	
Ignition System	• with diagnostic equipment, diagnose ignition system and document specifics • service spark plugs, wires, distributor cap, rotor, points, pick-up coil, spark advance • check and adjust ignition timing.	
Starting System	• operate starter and determine if problem exists (noises, drive engagement, speed, etc.) • check amperage draw • check circuit voltage drops • check battery condition.	
Charging Systems	• do a visual check; i.e., wires, connections, belt condition/tension • check alternator for noise, vibration • check alternator output and voltage regulation.	
Computer Controlled System	• diagnose, using appropriate diagnostic equipment and document faults.	Diagnostic equipment required.

Concept	Specific Learner Expectations	Notes
Emission Control	*The student should:* • determine what emission control devices exist on vehicle and what emissions are being controlled • determine to what standards these devices control emissions • check if vehicle meets standards • correct faulty condition.	If equipment is available.
Performance and Drive ability	• road test vehicle to determine engine performance and drive ability.	
Synthesis	• compile a report outlining test results, work done and present condition of engine and related parts/systems.	Diagnostic printout.
Career Exploration	• identify further education and work opportunities related to engine tune-ups.	

MODULE MEC305: ENGINE REMOVAL AND INSTALLATION

Level: **Advanced**

Theme: **Propulsion Systems**

Prerequisite: **Engine Performance Diagnosis (MEC303; recommended)**

Module Parameters: **Access to engine lift tools/equipment and supporting resources**

Students remove and install an engine in a chassis.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student achievement will be based on:*	
• safely use engine lifting tools/equipment	• observed performance in: – application and use of lifting tools and equipment – safely removing and installing an engine – following established shop/lab routines. *Assessment Tool* *To be developed* *Standard* *To be developed*	10
• identify steps involved in preparing a vehicle for engine removal	• given a specific vehicle, identifying: – how engine will be removed (e.g., transmission) – specific steps involved up to the point of engine removal. *Assessment Tool* *To be developed* *Standard* *To be developed*	15
• remove and install an engine in a chassis	• observed performance in removing and installing an engine. *Assessment Tool* *To be developed* *Standard* *To be developed*	45

MODULE MEC305: ENGINE REMOVAL AND INSTALLATION (continued)

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• remove and replace engine accessories	• observed performance in removing and installing engine accessories including wiring, hoses, cables, clamps, fluids, etc. *Assessment Tool* *To be developed* *Standard* *To be developed*	30
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal interaction during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Safety and Environmental Concerns	*The student should:* • know types of lifting tools/equipment available for engines • know where to attach devices • determine procedures to follow to remove and install an engine • observe precautions when working with vehicle equipped with air conditioning.	Tool, bolt size, location, torque.
Problem Solving/ Decision Making	• determine how to park and take steps to protect a vehicle in preparation for engine removal • identify all wiring, hoses, cables, pipes that require disconnecting • identify units and special fasteners that will be removed.	Paint protection; scribing/marking components. Masking; photograph. With or without transmission, motor mounts.

MODULE MEC305: ENGINE REMOVAL AND INSTALLATION (continued)

Concept	Specific Learner Expectations	Notes
Removal and Replacement	*The student should:* • disconnect and service battery • drain and dispose of lubricant and coolant • remove appropriate wires, hoses, cables, pipes, units • remove and/or install an engine • dismantle/assemble an engine • reconnect all disconnects • install lubricants/coolant • service and store battery • drain/store or dispose fluids • determine the most appropriate method and remove and replace the following: – wires – cables – hoses – pipes – accessories – cylinder head – cylinder block..	Blocking fuel line; fasteners organized. Allow for rebuilt components to be used: heads, short blocks. Gasoline removal and storage precautions. Organizing fasteners. Identification of disconnects for later connects. Depending on circumstance, engine may be removed as an assembly.
Service	• adjust and service engine.	
Evaluation	• start engine and check for proper performance.	Module maybe combined with Engine Performance Diagnosis (MEC303), Engine Tune-ups (MEC304), Engine Reconditioning I (MEC306, Engine Reconditioning II (MEC307).
Career Exploration	• identify further education and work opportunities related to engine removal and installation.	Trade areas.

MODULE MEC306: ENGINE RECONDITIONING I

Level: **Advanced**

Theme: **Propulsion Systems**

Prerequisites: **Engine Fundamentals (MEC104)**
Engine Performance Diagnosis (MEC303)
Engine Tune-up (MEC304; recommended)

Module Parameter: **Access to cylinder head rebuilding equipment measuring tools and related resources**

Students determine the need for service and perform the required service for the cylinder head and related components.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• demonstrate safety procedures related to cylinder head work	• observed performance in following: – precautions related to removal and installation of cylinder head(s) – safe practices in reconditioning cylinder head(s). *Assessment Tool* *To be developed* *Standard* *To be developed*	10
• determine the need for cylinder head service	• report content providing information, including: – indicators dictating cylinder head work – possible faults suspected. *Assessment Tool* *To be developed* *Standard* *To be developed*	15

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• recondition a cylinder head	• observed performance in: – disassembly of a cylinder head – checking/measuring to determine condition of cylinder head, valves, seats, guides, springs – reconditioning valves, seats and guides – assembly of cylinder head and required checks—valve spring and stem heights. *Assessment Tool* *To be developed* *Standard* *To be developed*	45
• service cylinder head-related components	• observed performance in servicing: – rocker arms (shafts) – push rods – camshaft – lifters – sprockets, gears, chains *Assessment Tool* *To be developed* *Standard* *To be developed*	15
• remove and install cylinder head	• observed performance in: – removing a cylinder head according to manufacturer's recommended procedures – installation of cylinder head and related components observing torque and sequence, head gasket positioning and other related gaskets – adjustments related to the work. *Assessment Tool* *To be developed* *Standard* *To be developed*	15
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal interaction during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

MODULE MEC306: ENGINE RECONDITIONING I (continued)

Concept	Specific Learner Expectations	Notes
Safety and Environmental Concerns	*The student should:* • follow lab safety procedures.	
Investigation	• perform checks to determine condition of cylinder head and related parts.	Compression test, vacuum test, valve timing, oil pressure.
Performance Modification	• research blue printing procedures for cylinder heads • investigate costs.	
Servicing	• clean cylinder head and related parts • inspect parts for serviceability • machine parts • assemble cylinder head and check valve spring and stem height • service push rods, lifters, rocker arms, chain, gears and camshaft, pulleys, belts • install cylinder head and make adjustments.	Field trips to machine shops. Cracks, warpage, guide, valve stem wear. Grind valves, seats, recondition guides. Torque, sequence, specification and techniques.
Evaluation	• run engine and evaluate work done • adjust to specifications.	
Career Exploration	• research the demand for skills related to engine reconditioning.	

MODULE MEC307: ENGINE RECONDITIONING II

Level: **Advanced**

Theme: **Propulsion Systems**

Prerequisites: **Engine Fundamentals (MEC104)**
Engine Performance Diagnosis (MEC303)
Engine Reconditioning I (MEC306; recommended)

Module Parameters: **Access to engine measuring tools, cylinder block reconditioning tools/equipment and related resources**

Students determine the need for service, and perform service on a cylinder block assembly and related components.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• demonstrate safety procedures while reconditioning cylinder blocks	• observed performance in: – following established shop/lab routines – safely using engine reconditioning tools/equipment. *Assessment Tool* *To be developed* *Standard* *To be developed*	10
• determine the need for cylinder block service	• given an engine, being able to determine: – the need for work through inspection of cylinder block, pistons, rods, crankshaft, camshaft, bearings and other related components – cost of repair – the appropriate procedure to follow considering all factors. *Assessment Tool* *To be developed* *Standard* *To be developed*	30

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:.*	
• recondition a cylinder block and related components	• given a cylinder block, observed performance in reconditioning: – cylinder block – connecting rods – pistons. *Assessment Tool* *To be developed* *Standard* *To be developed*	40
	• given a disassembled cylinder block, assemble according to manufacturer's recommendations. *Assessment Tool* *To be developed* *Standard* *To be developed*	20
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal interaction during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Safety and Environmental Concerns	*The student should:* • follow safety practices related to reconditioning cylinder blocks.	
Problem Solving	• list possible engine problems based on information provided.	Customer complaints.

MODULE MEC307: ENGINE RECONDITIONING II (continued)

Concept	Specific Learner Expectations	Notes
Performance Modification	*The student should:* • research blue printing procedures for cylinder blocks • estimate costs.	
Evaluating Conditions	• clean all engine block components • inspect following components for serviceability: – block – cylinder(s) – crankshaft – camshaft(s) – piston(s) – connecting rod(s) – lifters – bearings – chains, sprockets, pulleys, belts – other • assess what servicing is required.	Block disassembled in MEC304. Alignment, warpage, cracks. Size, taper, out-of-roundness, condition. Bends, cracks, journal size, taper, out-of-roundness, condition. Bends, lobe/journal wear (if part of the block). Size, taper, condition, piston clearance, piston pin, grooves. Straightness, big/small end size. Base wear, condition. Camshaft—size, wear.
Servicing	• machine/service components as required.	Deglaze, bore, hone, resize, replace.
Assemble	• assemble engine block observing proper tolerances.	Combine with Engine Tune-ups (MEC304), Engine Removal and Installation (MEC305) for installation and running.
Career Exploration	• research the demand for skills related to engine reconditioning.	

MODULE MEC308: ALTERNATE PROPULSION SYSTEMS

Level: **Advanced**

Theme: **Propulsion Systems**

Prerequisites: **Alternative Fuel Engines (MEC205)**
Engine Fundamentals (MEC104; recommended)

Module Parameters: **Access to support resources**

Students develop an understanding of why vehicle manufacturers continue to build the crank-piston, internal combustion, gasoline engine and also explore some other engine designs.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• research and describe the historical development of commonly used engine designs from Nickolous Otto to present manufacturing techniques	• a report generated indicating: – historical development of internal combustion engines – engine manufacturing techniques. *Assessment Tool* *To be developed* *Standard* *To be developed*	20
• explore engine design innovation such as using different fuels in present engines and using present fuels in engines of different design	• a report with the following: – engine design and how it relates to fuel used (other than gasoline) – alternate engine designs (other than conventional piston engine) indicating relative advantages and disadvantages – status of electric powered vehicles. *Standard* *To be developed* *Assessment Tools* *To be developed*	25
• identify opportunities for future development in this specialized area of manufacture and repair	• identified opportunities for future development of alternative propulsion systems. *Assessment Tool* *To be developed* *Standard* *To be developed*	25

MODULE MEC308: ALTERNATE PROPULSION SYSTEMS (continued)

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• examine available alternative systems	• listing and describing present alternative systems indicating positive and negative factors. *Assessment Tool* *To be developed* *Standard* *To be developed*	30
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal interaction during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
History of Internal Combustion Engines	*The student should:* • prepare and present a report detailing the origin of the first working internal combustion engine, the major advances made in the design of internal combustion engines and the manufacturing process improvements that made those innovations possible over the history of engine design.	Turbo charging. Super charging.
Other Engine Fuels	• determine the rationale for change in engine design considering the factors of environmental and fuel supply significance • prepare and present a study of initiatives for using alternate fuels in engines and the factors affecting these situations.	

MODULE MEC308: ALTERNATE PROPULSION SYSTEMS (continued)

Concept	Specific Learner Expectations	Notes
Other Engines	*The student should:* • examine the developments of and compare the relative efficacy of alternative contemporary design engines to the large-scale manufacture of motor vehicles. The engines examined might include the following: Wankel, Gas Turbine, New Concept Rotary, Kauertz Rotary Vane, Rotorcam, Split-Cycle Mighty-Mite, Bricklin Rotary Vee, Reg Technologies Rand Cam Selwood Orbital and Stirling • examine and report on the present initiatives to build electric-powered cars and batteries of sufficient capacity to power them • determine which direction of alternative propulsion system development promises the most likely success.	
Career Opportunities	• predict the opportunity for career opportunities related to emerging technological development.	

MODULE MEC309: COMPUTER MANAGEMENT SYSTEMS

Level: **Advanced**

Theme: **Guidance and Control Systems**

Prerequisite: **Electrical Components (MEC209; recommended)**

Module Parameters: **Access to computer management system diagnostic equipment and related resources**

Students acquire an overview of the application of computer management systems used in modern vehicles.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• demonstrate established procedures of safety and care related to computer management systems	• measured performance related to: – demonstrating compliance with safety and care related to computer systems – care and safety in the use of tools, equipment and materials – anti-static precautions associated with the handling of CPUs. *Assessment Tool* *To be developed* *Standard* *To be developed*	15
• identify the principles that apply to all computer management systems	• observed performance related to: – identification of common principles shared by all computer management systems – comparisons between input devices and output devices used in vehicles and on PCs. *Assessment Tool* *To be developed* *Standard* *To be developed*	20

MODULE MEC309: COMPUTER MANAGEMENT SYSTEMS (continued)

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• locate the components of selected computer management systems and describe their function	• observed performance related to: – location of the components of computer management systems – descriptions of component points and their relationship to the systems. *Assessment Tool* *To be developed* *Standard* *To be developed*	15
• demonstrate how computer management systems operate	• measured performance related to: – demonstrating how computer management systems get information, process information and make adjustments – changing input values and predicting output values on a computer system or schematic. *Assessment Tool* *To be developed* *Standard* *To be developed*	20
• perform diagnostic analysis of selected computer management systems and make required repairs or replacement of malfunctioning parts	• measured performance related to: – correct diagnosis and analysis of computer management systems – procedures for repair or replacement of parts – accuracy and skill in performing task. *Assessment Tool* *To be developed* *Standard* *To be developed*	30
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal interaction during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

MODULE MEC309: COMPUTER MANAGEMENT SYSTEMS (continued)

Concept	Specific Learner Expectations	Notes
Safety and Environmental Concerns	*The student should:* • follow practices that promote safety for people and the environment.	Damage precautions regarding CPU units.
Computer Control Systems Used in Modern Vehicles	• identify the different computer control systems that are now available on vehicles • discuss the functions these computer control systems perform • state the ways in which these computer control systems replaced mechanical systems • demonstrate how selected computer control systems work compared to the old mechanical systems.	
Essentials of Computer Control Systems	• identify the principles and functions of computer control systems • locate and identify the parts of selected computer management systems • describe the function of the parts of a selected computer management system.	
Diagnosis and Repairs	• perform diagnostic analysis of selected computer management systems • replace parts or make necessary repairs to correct malfunctioning computer management systems.	Faulty diagnostics will damage CPU unit.
Future Computer Management Systems	• forecast types of computer management systems that may be used on future vehicles.	

MODULE MEC310: SAFETY SYSTEMS

Level: **Advanced**

Theme: **Guidance and Control**

Prerequisites: **Power Assist Accessories (MEC210)**
Electrical Components (MEC209; recommended)

Module Parameters: **Access to support resources and vehicles with safety systems**

Instructional Qualification: Client work must be checked by certified technician

Students gain an understanding of how safety systems can be tested, diagnosed, replaced or repaired.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• demonstrate established procedures of safety and care while working with safety systems	• observed performance related to: – appropriate use of equipment, tools and materials when working on safety systems – specific procedures used when working on safety systems such as ABS and air bags. *Assessment Tool* *To be developed* *Standard* *To be developed*	10
• research, list and compare safety systems that protect vehicle occupants	• measured performance related to: – research of vehicle safety systems – comparisons of types of safety systems – developments of safety systems – predictions about possible future safety systems. *Assessment Tool* *To be developed* *Standard* *To be developed*	40

MODULE MEC310: SAFETY SYSTEMS (continued)

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• diagnose and service problems with vehicle safety systems	• observed performance related to: – accurate diagnosis of problems in safety systems – procedures followed to service safety systems. *Assessment Tool* *To be developed* *Standard* *To be developed*	50
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal interaction during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Safety and Environmental Concerns	*The student should:* • demonstrate and follow established safety rules when working on safety systems.	Caution: SRS system. Note potential for injury from deployment of SRS systems; e.g., air bags, seat belt tensioners.
Vehicle Care and Safety	• display the use of safety procedures and precautions necessary to avoid damage to vehicle safety systems.	Need for resources.
History of Safety Systems	• research safety systems found in automobiles and list the dates various safety systems were introduced in the vehicle • discuss the effect various safety systems have had in reducing fatalities • debate which safety systems are most effective in human lives, cost of manufacture and ease of use.	

MODULE MEC310: SAFETY SYSTEMS (continued)

Concept	Specific Learner Expectations	Notes
Safety System Components	*The student should:* • identify safety systems in selected vehicles • list the parts of these safety systems • describe the function of these systems.	
Diagnosis and Repair of Safety Systems	• diagnose the condition and any problems found on safety systems • replace parts or make repairs to malfunctioning parts of safety systems.	

MODULE MEC311: CLIMATE CONTROL

Level: **Advanced**

Theme: **Guidance and Control Systems**

Prerequisite: **Lubrication and Cooling Systems (MEC203; recommended)**

Module Parameters: Access to air conditioning test equipment and support resources

Instructional Qualification: Client work must be checked by certified technician

Students expand their knowledge of the purpose, operation and servicing of standard heating and air conditioning systems.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• demonstrate established procedures of safety and care when working with climate control systems specifically and motor vehicles generally	• measured performance related to: – safety when working on climate control systems – procedures followed when working with refrigerants – safety and care used with vehicles, equipment, tools and materials. *Assessment Tool* *To be developed* *Standard* *To be developed*	15
• identify the purpose and describe the functions of heater and air conditioning system components	• observed performance related to: – identification of the parts/components – description of the function of heater and air conditioning – describe how the components combine their functions to produce heat or cold. *Assessment Tool* *To be developed* *Standard* *To be developed*	25

MODULE MEC311: CLIMATE CONTROL (continued)

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• carry out inspection, diagnosis, service and repair procedures on heater and air conditioning systems and components of those systems	• observed performance related to: – inspection of climate control systems as outlined in service manuals and shop procedures – accurate diagnosis of climate control systems performance – repairs to climate control systems as outlined in manuals and procedures. *Assessment Tool* *To be developed* *Standard* *To be developed*	40
• identify global concerns about the release of refrigerants into the atmosphere as well as the alternatives to standard refrigerants and the required recycling procedure	• measured performance related to: – research into the effect of refrigerants on the eco-system – research into alternate refrigerants – understanding of recycling laws and procedures. *Assessment Tool* *To be developed* *Standard* *To be developed*	20
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal interaction during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Safety and Environmental Concerns	*The student should:* • follow lab safety procedures.	

MODULE MEC311: CLIMATE CONTROL (continued)

Concept	Specific Learner Expectations	Notes
Heater Operation	*The student should:* • describe the operation of the heater: heat exchange, the operation of controls for fan speed, and air flow controls.	
Air Conditioner Operation	• identify components of an air conditioning system • describe refrigeration principles • describe air conditioning system operation.	
Safety and Environmental Concerns with Refrigerant	• generate a list of safety concerns when working with refrigerants • outline the legal restrictions about the disposal and recycling of R–12 refrigerants • identify the safety and environmental concerns with R–12 and R–12 replacements.	Legal restriction in disposal and reclaiming of R–12. Mixing refrigerants. Safety precautions when in contact with R–12 and when R–12 is in contact with open flame creating toxic gas.
Inspection and Diagnosis	• determine the causes and repair procedures for standard heater operation malfunctions; e.g., blocked or leaking heater core, temperature cable adjustment, fan motor noise, vibration and speed abnormalities • conduct a visual and tactile check of operation of the refrigerant system and assess the service needs • pressure test the air conditioning refrigerant system and confirm the normalcy of system operation by comparing data with service manual.	
Service and Repair	• determine cause of malfunction in a climate control system and repair as required after consulting with the vehicle owner/teacher • on A/C system, leak test, evacuate system, recharge, then leak test again.	In the case of equipment or facility shortage, a community partnership would be most helpful. Oil may need to be added.
Career Exploration	• research the demand for skills in related to climate control.	

MODULE MEC312: POWER ASSISTING

Level: **Advanced**

Theme: **Guidance and Control Systems**

Prerequisites: **Electrical Components (MEC209) or**
Power Assist Accessories (MEC210) and
Hydraulic Accessories (MEC212; recommended)

Module Parameters: **Access to supporting resources, vacuum/pressure gauges, electrical test equipment**

Students further develop their knowledge of the purpose, operation, service and repair of pneumatic, hydraulic and electric power assist devices.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• demonstrate established procedures of safety and care when working with power assists	• observed performance related to: – personal safety when working with power assist systems – safety and care of vehicles, parts, equipment and materials – special precautions when working with power assists. *Assessment Tool* *To be developed* *Standard* *To be developed*	15
• identify applications of power assist components to various vehicle systems and determine the rationale for specific applications	• observed performance related to: – identification of power assist systems such as pressure pumps, vacuum and electric motors – identification of components of power assist systems – analysis of the purpose and rationale for using power assist systems. *Assessment Tool* *To be developed* *Standard* *To be developed*	25

MODULE MEC312: POWER ASSISTING (continued)

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• execute service and repair procedures to pneumatic, hydraulic and electric power assist devices according to manufacturer's prescribed methods	• measured performance related to: – service and repair to pneumatic, hydraulic and electric components – following procedures – achieving accurate measurements. *Assessment Tool* *To be developed* *Standard* *To be developed.*	60
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal interaction during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Safety and Environmental Concerns	*The student should:* • follow established lab procedures.	
Power Assist Applications	• describe situations in vehicle system design where power assist mechanisms are used • define the advantages of power assist over manual control as well as identify the type of power assist most adaptable for use in a particular situation.	

MODULE MEC312: POWER ASSISTING (continued)

Concept	Specific Learner Expectations	Notes
Hydraulic Assists	*The student should:* • complete an inspection of a hydraulic power assist device using manufacturer's prescribed diagnostic procedures • estimate the repair costs for a defective or broken hydraulic assist and confer with the teacher or vehicle owner regarding the repair requirements • complete a repair procedure on a hydraulic assist unit. This could be a seal, hose, pump, reservoir or valve repair.	Steering, brakes.
Pneumatic Assists	• complete an inspection of a pneumatic assist device or system using prescribed diagnostic procedures • prepare an estimate of the repair requirements of the pneumatic assist and confer with the teacher or vehicle owner regarding the repair needs • complete a repair procedure on a pneumatic assist unit or system. Repairs could include any aspect of the system or device.	Vacuum assist brakes. Load levelers.
Electrical Assists	• complete an inspection of an electric assist device using a prescribe diagnostic procedure • prepare an estimate of the repair requirements for the electric assist device and confer with the teacher or vehicle owner regarding the required repairs • complete a repair procedure to an electric assist device or system.	
Career Exploration	• identify further education and work opportunities related to power assist devices.	

MODULE MEC313: AUTOMATIC TRANSMISSIONS

Level: **Advanced**

Theme: **Guidance and Control Systems**

Prerequisite: **Hydraulic Accessories (MEC212; recommended)**

Module Parameters: **Access to automatic transmission diagnostic tools, support resources**

Instructional Qualification: Client work must be checked by certified technician

Students develop their knowledge of automatic transmissions and transaxles, and their skills in diagnosing and executing some automatic transmission and transaxle repair requirements.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• demonstrate established procedures of safety and care when working with automatic transmissions and transaxles	• observed performance related to: – personal safety procedures – safety and care when working with equipment, tools and materials – following safety procedures specific to automatic transmissions and transaxles. *Assessment Tool* *To be developed* *Standard* *To be developed*	15
• identify the parts of a torque converter and automatic transmission or transaxle and determine the path of power as well as the shifting control operation in each gear setting	• observed performance related to correct: – identification of parts – description of the power flow – explanation of the shifting control. *Assessment Tool* *To be developed* *Standard* *To be developed*	20

MODULE MEC313: AUTOMATIC TRANSMISSIONS (continued)

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• complete inspection, diagnostic, service and repair procedures on automatic transmissions and transaxle assemblies	• observed performance related to: – procedures followed during inspection, diagnosis, service and repair to automatic transmissions and transaxles – analysis of conditions that caused wear/malfunctions to automatic transmissions and/or transaxles. *Assessment Tool* *To be developed* *Standard* *To be developed*	65
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal interaction during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Safety and Environmental Concerns	*The student should:* • follow established lab procedures.	
Torque Converter	• describe the operation of a torque converter • differentiate between lock-up converter and non-lock-up converter operation by comparing the internal structure of each • perform a stall test.	According to manufacturer's specifications.

Concept	Specific Learner Expectations	Notes
Transmission/ Transaxle Inspection	*The student should:* • identify the parts of the transmission assembly in generic terminology by naming pieces on a diagram or parts of a disassembled unit • using a hydraulic flow diagram, explain the unit engaged as well as shift process for each gear position • interpret shifting characteristics resulting from differentiated inputs; e.g., high road speed, pulling heavy loads, throttle valve position.	
Transmission/ Transaxle Operation	• inspect oil level and develop an assessment of its smell and colour • check unit for oil leakage and determine a cause for loss of oil • evaluate the condition and adjustment of linkage.	
Problem Diagnosis	• use service manuals and road test to determine probable causes of noted conditions • initiate diagnostic procedures developed from service inquiry, which may include linkage adjustments, pressure testing and further road testing as well as partial disassembly of the transmission • list parts for required repairs.	For example, oil pan and/or valve body removal. Cost estimate may be done.
Servicing Automatic Transmission/ Transaxle Assemblies	• change transmission fluid and filter as described in the appropriate service manual • locate and correct a transmission linkage or band adjustment where required • remove, clean and reinstall a transmission valve body assembly • repair a fluid leak.	

MODULE MEC313: AUTOMATIC TRANSMISSIONS (continued)

Concept	Specific Learner Expectations	Notes
Repairing Automatic Transmission/ Transaxle Assemblies	*The student should:* • remove and repair or replace an automatic transmission assembly.	May require Career Transitions module for a customer vehicle.
Career Exploration	• identify further education and work opportunities related to automatic transmissions.	

MODULE MEC314: POWER TRAIN REPAIR

Level: **Advanced**

Theme: **Guidance and Control Systems**

Prerequisites: **Power Trains (MEC213)**
Manual Transmissions and Transaxles (MEC214; recommended)

Module Parameters: **Access to specialized power train tools supporting resources and power train units**

Students perform overhauls on clutch, transmission and differential assemblies.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• demonstrate established safe practices	• observed performance related to: – safe practices using equipment, tools, materials and while working in lab. *Assessment Tool* *To be developed* *Standard* *To be developed*	10
• replace clutch assembly	• measured performance related to clutch: – following shop procedures – following procedures in shop manuals – accuracy and quality of work. *Assessment Tool* *To be developed* *Standard* *To be developed*	15
• remove, overhaul and replace standard transmissions	• observed performance related to transmissions: – following shop procedures – following procedures in shop manuals – accuracy and quality of work. *Assessment Tool* *To be developed* *Standard* *To be developed*	35

MODULE MEC314: POWER TRAIN REPAIR (continued)

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• measure and adjust a differential assembly	• observed performance related to differentials: – accurate measurements – accurate adjustments – finding and following manufacturers specifications – information retrieval. *Assessment Tool* *To be developed* *Standard* *To be developed*	15
• overhaul drive axle assembly (CV joints)	• measured performance related to drive axles: – following shop procedures – accurate removal and overhaul of parts. *Assessment Tool* *To be developed* *Standard* *To be developed*	25
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal interaction during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Safety and Environmental Concerns	*The student should:* • follow established lab procedures.	Refer to asbestos hazards.
Clutch Repair	• remove and replace a clutch assembly • determine the serviceability of each part • adjust linkage to specified clearance.	

Concept	Specific Learner Expectations	Notes
Transmission and Transaxle Repair	*The student should:* • remove and replace specified transmission and overhaul to manufacturer's specifications • explain the operation and power flow in various transmissions and transaxles.	
Drive Axles	• describe the operation and components of four wheel, front wheel and rear wheel drives • overhaul constant velocity joints.	
Differential	• describe types of differential assemblies and explain operation of the following: – full floating – semi-floating – hunting – non-hunting • describe the operation of a limited slip differential assembly • measure and adjust a differential assembly.	

MODULE MEC315: WHEEL ALIGNMENT

Level: Advanced

Theme: Suspension and Structural Systems

Prerequisites: Suspension Systems (MEC215)
Steering Systems (MEC216; recommended)

Module Parameters: Access to wheel alignment equipment and supporting resources

Students develop the knowledge, skills and attitudes necessary for the alignment of various steering systems used on vehicles.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• follow established safe practices	• observed performance related to: – safe practices for personal safety – safe practices for vehicles. *Assessment Tool* *To be developed* *Standard* *To be developed*	10
• investigate and determine the condition of the various components affecting wheel alignment and correct as necessary	• measured performance related to pre-alignment: – determining the condition of steering components – determining the condition of suspension components – applying procedures and practices. *Assessment Tool* *To be developed* *Standard* *To be developed*	25
• identify measurements and angles that are incorporated into suspension and steering systems	• measured performance related to: – identification and measurement accuracy of angles checked – application of manufacturers specifications to shop vehicles checked. *Assessment Tool* *To be developed* *Standard* *To be developed*	25

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• use specialized alignment equipment to check and adjust alignment angles to manufacturer's specifications on various suspension types	• observed performance related to adjusting alignment angle: – information retrieval – accurate measurements – application of skills and knowledge – correct use of special tools/equipment. *Assessment Tool* *To be developed* *Standard* *To be developed*	30
• perform a road test and determine the quality of service work performed	• observed performance related to: – assessment of the work done – analysis of driving symptoms – care and safety procedures. *Assessment Tool* *To be developed* *Standard* *To be developed*	10
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal interaction during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Safety and Environmental Concerns	*The student should:* • follow lab safety procedures.	
Alignment Principles and Angles	• define and explain camber, caster, toe, steering axis inclination, toe-out on turns and tracking.	

MODULE MEC315: WHEEL ALIGNMENT (continued)

Concept	Specific Learner Expectations	Notes
Pre-alignment Inspection	*The student should:* • check and correct tire pressures and determine reason for abnormal tire wear • check and adjust wheel bearings • check and adjust wheel/tire run out • check and correct tire balance • check and correct steering linkage problems • check and adjust steering gear • check and correct shock absorber problems • check and correct riding height • check vehicle tracking.	
Determining Alignment Angles	• using alignment equipment, check alignment angles for a given vehicle.	
Adjusting Angles	• using alignment equipment, adjust alignment angles to manufacturer's specifications on at least two different suspension types.	
Troubleshooting Steering and Suspension Problems	• be able to solve common steering and suspension problems; e.g., – loose steering – hard steering – vehicle wander – vehicle pulls to one side – wheel shimmy – wheel tramp – improper tire wear.	
Evaluating Steering After An Alignment	• through a road test, determine whether proper steering and ride exists.	
Career Exploration	• identify further education and work opportunities related to wheel alignment.	

MODULE MEC316: BODY REPAIR ESTIMATION

Level: **Advanced**

Theme: **Suspension and Structural Systems**

Prerequisite: **Vehicle Structures and Materials (MEC116; recommended)**

Module Parameters: **Access to supporting resources**

Students learn the value of detail in the determining of cost of repair and acquire knowledge in estimating.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• state the role of insurance in industry and legal obligations involved in estimating	• presentation showing knowledge of terms: – "insurance" – "liability" – "waiver" – "write-off" – "premium"/"deductible". *Assessment Tool* *Report Assessment Form, MEC REP 2* *Standard* *Performance rating of 3 on each criteria*	10
• investigate and acquire knowledge of vehicle construction and part costs	• presentation of a report showing knowledge of: – collision damage/direct – hidden damage – accessory parts – parts sources and prices (OEM versus aftermarket) – problem solving of damage owing to collision. *Assessment Tool* *Report Assessment Form, MEC REP 2* *Standard* *To be developed*	20

MODULE MEC316: BODY REPAIR ESTIMATION (continued)

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• demonstrate skills needed to successfully "estimate" collision damage	• demonstration/observed knowledge of methods needed to estimate, including: – frame damage analysis – accessory parts knowledge – mathematics skills required for cost analysis. *Assessment Tool* *Problem-solving Assessment Tool, MEC PRO 5* *Standard* *To be developed.*	25
• complete an estimate to automobile industry standards, including decision on replacement or repair	• given a damaged vehicle, students will perform and demonstrate: – problem-solving ability in determining cost of repair – knowledge of vehicle value versus repair cost – industry standard of estimate of repair including parts, labour costs, shop costs, miscellaneous costs. *Assessment Tool* *Problem-solving Assessment Tool, MEC PRO 5* *Standard* *To be developed*	45
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal interaction during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Safety and Environmental Concerns	*The student should:* • follow lab safety procedures.	
Terminology	• know the terms used in the appraisal industry.	

Concept	Specific Learner Expectations	Notes
Vehicle Construction and Collision Damage	*The student should:* • investigate vehicle construction systems (unibody and framed) and safety requirements • examine the effects of collision on vehicle structure, parts and passengers • demonstrate the effects of forces on metal and show how manufactured techniques are used to absorb collision energy • define the terms "primary damage", "secondary damage" and "hidden damage" • identify relate damaged parts.	
Collision Damage Analysis	• investigate collision damage incurred to: – determine direction of damage – list part damaged (including hidden damage) – list signs of hidden damage and physically remove appropriate parts to further the investigation • demonstrate knowledge of mechanical and electrical components generally damaged in collision and state appropriate safety precautions in dealing with gas, oil, air conditioning and acid • conduct tests to determine mechanical and/or electrical functions in order to properly estimate cost of collision damage.	

Concept	Specific Learner Expectations	Notes
Measurements and their Meaning	*The student should:* • use collision repair guides to show correct alignment of frame and suspension parts and list parts needed for repair • describe three methods of measuring frame and body parts for misalignment: – taping – tramming – self-centering gauges • describe the signs of misalignment from a process using self-centering gauges and indicate their appropriate path of repair • list suspension parts that are damaged in collision and cost of replacement.	
Estimating Costs	• investigate the cost of OEM, after market and used parts that could be used in a repair • complete a replacement parts list for a given collision, including "cost", "extended cost", and "contracted" costs • list examples of hidden and "other" costs that must be included in an estimate of collision damage • describe the responsibility of the shop to the customer, the insurer and legal parties in doing an estimate; e.g., safety of vehicle • define "write-off" and explain when a vehicle is considered a write-off and non-repairable • explain the advantages of vehicle structure and repair knowledge when completing an estimate for repair.	
Career Opportunities	• identify further education and work opportunities related to body repair estimation.	

MODULE MEC317: STRUCTURAL DAMAGE ANALYSIS

Level: **Advanced**

Theme: **Suspension and Structural Systems**

Prerequisites: **Suspension Systems (MEC215) and/or Steering Systems (MEC216; recommended)**

Module Parameters: **Access to damaged vehicle, measuring gauges and related resources**

Students identify and examine physical damage caused by collision, including cost estimating procedures.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• demonstrate established safe procedures	• observed performance related to: – safe positioning of vehicle jacks and jack stands – following shop routines in removal of parts. *Assessment Tool* *Safety–Care Checklist, MEC SAF 1* *Standard* *To be developed*	10
• identify types and signs of damage caused by collision	• presentation of a report describing: – vehicle construction and safety features preventing collision damage – frame types and related damage – signs of secondary and hidden damage – methods used to determine damage. *Assessment Tool* *Report Assessment Form, MEC REP 2* *Standard* *To be developed*	15

MODULE MEC317: STRUCTURAL DAMAGE ANALYSIS (continued)

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• examine and successfully use measurement methods to determine extent of damage	• given a damaged vehicle, the student will perform the necessary measurements to show: – direction and extent of damage – suspension problems that might exist. *Assessment Tool* *Task Assessment Checklist, MEC TSK 4* *Standard* *To be developed*	30
• produce a damage collision estimate in line with industry standards and show cost effectiveness in decision making for repairs	• given a damaged vehicle, the student will perform and demonstrate: – problem-solving ability in determining cost of repair – knowledge of vehicle value versus repair costs – industry standard estimate of repair including parts, labour and shop costs. *Assessment Tool* *Problem-solving Assessment Tool, MEC PRO 5* *Standard* *To be developed*	45
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal interaction during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Safety and Environmental Concerns	*The student should:* • follow established lab procedures.	

MODULE MEC317: STRUCTURAL DAMAGE ANALYSIS (continued)

Concept	Specific Learner Expectations	Notes
Vehicle Construction Principles	*The student should:* • examine the manufacturer's methods used in vehicle construction; learn the terminology used to identify vehicle body parts • investigate methods used in vehicle construction to control damage through energy transfer and differences in strength • identify the specific occupant safety features built into the vehicle as required by law or provided as an option • estimate repair or replacement of safety equipment damaged in a collision.	ABS, air bag, suspension and personal restraint systems.
Measurement for Alignment	• examine the basic frame structures used in auto construction, and the measurement charts used to determine misalignment • conduct frame alignment measurements to determine extent of misalignment and explain the results of the measurements • use frame gauges and charts • analyze measurements and determine repair procedure.	
Damage Estimate	• demonstrate basic principles of estimating damage repair and apply to a specific situation • examine the value of using used, after market or OEM parts in any given repair • complete a damage appraisal for a given vehicle, including an analysis of cost–effect repair • explain when a vehicle is considered a "write-off".	
Career Exploration	• explore further education and work opportunities related to structural damage analysis.	

MODULE MEC318: STRUCTURAL DAMAGE REPAIR I

Level: Advanced

Theme: Suspension and Structural Systems

Prerequisites: Metal Forming and Finishing (MEC117)
Structural Damage Analysis (MEC317; recommended)

Module Parameters: Access to specialized body tools, hand tools and related resources.

Instructional Qualification: Client work must be checked by certified technician

Students complete a repair involving removal, replacement and alignment of body parts.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• demonstrate established safety procedures	• observed performance related to the safe handling and use of tools and equipment. *Assessment Tool* *Safety–Care Checklist, MEC SAF 1* *Standard* *To be developed*	10
• follow an approved sequence of repair involving removal and replacement of damaged external parts	• observed performance related to the ability to: – analyze correct repair sequence – perform removal of parts and accessories required – organize work and work site. *Assessment Tool* *Task Assessment Checklist, MEC TSK 4* *Standard* *Performance rating of 3 on each criteria*	25

MODULE MEC318: STRUCTURAL DAMAGE REPAIR I (continued)

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• align parts used in repair and prepare for paint or priming	• observed performance related to the ability to: – repair parts that can be repaired – replace parts and correctly align showing knowledge of alignment principles. *Assessment Tool* *Task Assessment Checklist, MEC TSK 4* *Standard* *To be developed*	40
• remove and replace trim parts as required	• observed knowledge in: – problem solving damage – parts required/repaired – costs incurred owing to collision and repair – cost-effective repair, write-off decision. *Assessment Tool* *Problem-solving Assessment Tool, MEC PRO 5* *Standard* *To be developed*	25
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal interaction during the instructional period. *Assessment Tools* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Safety and Environmental Concerns	*The student should:* • follow established lab procedures.	

Concept	Specific Learner Expectations	Notes
Damage Repair Sequence	*The student should:* • examine collision or weather damage to external parts and determine appropriate repair sequence • complete a list of required parts and show cost-effectiveness of using aftermarket or used parts • successfully remove trim and damaged parts, showing knowledge of tools and care for property • demonstrate skill and patience in the preparation of existing flanges, edges and mounting points used for replacement of new parts.	
Replacement Parts	• follow approved safety procedures in the use of jacks, jack stands, impact wrenches, torches, plasma arcs and abrasive cutters in the replacement of parts • demonstrate knowledge, skills and attitudes in the use of hand tools, and performing correctness of task.	Consideration must be given to techniques that prevent damage to adjacent surfaces or parts.
Alignment	• list methods used in the manufacture of vehicles to align adjacent parts, including shims, slotted holes and bending • safely remove and replace a door, hood and/or trunk lid • replace and align a fender • examine the bumper shock system and explain the effects of collision to "bumper shocks" and their alignment • describe the importance of correct alignment of body parts and the effects of "misalignment", both aesthetically and physically.	
Trim Replacement	• understand the function of trim • examine methods of trim fastening • remove and install trim and recognize the value of using OEM trim parts.	

Concept	Specific Learner Expectations	Notes
Career Exploration	*The student should:* • identify further education and work opportunities related to structural damage repair.	

MODULE MEC319: STRUCTURAL DAMAGE REPAIR II

Level: Advanced

Theme: Suspension and Structural Systems

Prerequisites: Suspension Systems (MEC215)
Steering Systems (MEC216)
Metal Repair and Finishing (MEC217)
Surface Preparation II (MEC219)
Structural Damage Repair I (MEC318; recommended)

Module Parameters: Access to hydraulic push/pull equipment, MIG and cutting equipment, basic body tools and related resources

Instructional Qualification: Client work must be checked by certified technician

Students examine the methods used to complete a collision repair that involves unibody parts replacement and frame correction.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• demonstrate established safety procedures	• observed performance related to the safe handling of vehicles in repair. *Assessment Tool* *Safety–Care Checklist, MEC SAF 1* *Standard* *To be developed*	10
• understand construction of modern vehicles and the methods needed to repair vehicle bodies	• presentation of a report describing vehicle construction, showing knowledge of: – HSS/HSLA metals – unibody construction – frame construction. *Assessment Tool* *Report Assessment Form, MEC REP 2* *Standard* *To be developed*	10

MODULE MEC319: STRUCTURAL DAMAGE REPAIR II (continued)

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• examine the function of a "bench" frame straightening system and related measurements	• presentation of a report describing vehicle repair procedures when using modern "frame" equipment, including knowledge of "measurement" charts and parts terminology. *Standard* *To be developed* *Assessment Tool* *Report Assessment Form, MEC REP 2*	15
• apply measurement techniques required to determine misalignment of frame and suspension	• observed performance given a damaged vehicle, the student will show knowledge in: – problem solving/analyzing existing damage – resource manuals available to assist repair analysis – suspension geometry. *Assessment Tool* *Task Assessment Checklist, Appendix 1.5* *Standard* *Performance rating of 3 on each criteria*	25
• experience repair involving replacement of unibody panels and use of hydraulic jacks	• observed performance related to the use of hydraulic push/pull equipment and unibody panel replacement, and skills demonstrated in: – safety required for equipment used – welding and cutting tool use – alignment and fabrication of damaged parts. *Assessment Tool* *Task Assessment Checklist, MEC TSK 4* *Standard* *To be developed*	25
• explain the importance of proper frame and suspension alignment including legal implications	• ability to identify suspension parts and problems incurred by misalignment owing to collision. *Assessment Tool* *Problem-solving Assessment Tool, MEC PRO 5* *Standard* *Performance rating of 3 on each criteria*	15

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will: • demonstrate effort to develop basic competencies.	*Assessment of student assessment will be based on:* • observations of individual effort and interpersonal interaction during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Safety and Environmental Concerns	*The student should:* • follow lab safety procedures.	
Frame Structures and Repair	• investigate and describe three kinds of frame structures, giving the advantages and applications of each • define the terms HSS and HSLA, and explain the need for these metals in unibody construction • explore the "bench system" used by professional auto repair shops in unibody collision repair • describe the use of measurements and measurement charts in determination of misalignment • define terms: "twist", "sag", "sway" and "diamond" • analyze measurements that will indicate each of the above conditions.	
Unibody Repair	• describe the correct procedure used to repair a unibody frame that shows misalignment • learn the use of hydraulic jacking systems in the repair of collision damage • practice safety procedures required in the use of hydraulic jacks, MIG welding and cutting equipment.	

Concept	Specific Learner Expectations	Notes
Suspension Alignment	*The student should:* • identify three kinds of suspension systems used by auto makers • define terms: "toe-in", "camber", "castor" and explain how each affects car tracking and drive ability • list the safety implications of collision damage causing suspension misalignment, including legal implications.	

MODULE MEC320: REFINISHING II

Level: **Advanced**

Theme: **Suspension and Structural Systems**

Prerequisite: **Refinishing I (MEC220)**

Module Parameters: **Access to spray equipment, surface repair equipment and related resources**

Students demonstrate knowledge and skills of advanced finishing techniques including custom painting, mixing, tinting, colour and texture matching.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• demonstrate safe practices and follow all explicit warnings identified by the manufacturer and Occupational Health and Safety	• observed performance related to: – safe handling of chemicals and paint products – knowledge of potential dangers with improper use – proper use of resources (WHMIS/MSDS) – follow shop routines for painting. *Assessment Tool* *Safety–Care Checklist, MEC SAF 1* *Standard* *To be developed*	15
• investigate advanced products, techniques and equipment used in obtaining acceptable OEM finish	• presentation of a report demonstrating knowledge of: – base/clear systems – plastic coatings – colour matching using colour-code references. *Assessment Tool* *Report Assessment Form, MEC REP 2* *Standard* *To be developed*	25

MODULE MEC320: REFINISHING II (continued)

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• apply an advanced type of refinish	• observed performance in application of overall refinish product in a special situation: – tutone – striped – custom. *Assessment Tool* *Task Assessment Checklist, MEC TSK 4* *Standard* *To be developed.*	60
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal interaction during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
Safety and Environmental Concerns	• know health hazards and environmental impacts of products used.	Supplier recommendations.
Advanced Refinishing Equipment	• have knowledge of alternate spray equipment • understand types and use of spray booths • have knowledge of compressors, drying systems.	Airless spray gun, electro static, air brushes, touch-up gun. Type, maintenance.
Advanced Paint Application	• demonstrate advanced application techniques • perform advanced troubleshooting of application/equipment problems.	Application consistency, improved gun control.

MODULE MEC320: REFINISHING II (continued)

Concept	Specific Learner Expectations	Notes
Application of Colour Coats on Plastic and Vinyl	*The student should:* • demonstrate proper selection and application of colour coats for plastic and vinyls.	Bumper paint, vinyl roofs.
Custom Painting	• research styles and techniques of custom painting.	
Mixing and Tinting Systems	• have knowledge of mixing and tinting systems.	Tour body shop and/or post-secondary institute.
Colour and Texture Matching	• analyze colour/texture and recognize the following: – lightness/darkness – cast – brightness • have a knowledge of colour tinting.	Matching colours and metallics.
Textured Finishes	• have knowledge/application of textured finishes.	Rock guard, spatter finishes.

MODULE MEC321: PLASTIC AND FIBREGLASS

Level: **Advanced**

Theme: **Suspension and Structural Systems**

Prerequisite: **Vehicle Structure and Materials (MEC117; recommended)**

Module Parameters: **Access to plastic welding equipment and related materials and resources**

Students determine the type of plastic/fibreglass material and perform the repair procedure.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• identify hazards and safety precautions to be observed when working with plastics	• presentation of a report identifying observed performance related to: – use of plastic repair materials – personal safety requirements – following appropriate safety roles. *Assessment Tool* *Safety–Care Checklist, MEC SAF 1* *Standard* *To be developed*	10
• describe the types of plastics, weld equipment and bond processes to be used in repairing specific plastics	• preparation and submission of a chart indicating: – plastic types – repairability – materials required for repair – precautions for safety. *Assessment Tool* *Report Assessment Form, MEC REP 2* *Standard* *To be developed*	15
• do a plastic weld and bond	• observed performance in completion of a plastic repair. *Assessment Tool* *Task Assessment Checklist, MEC TSK 4* *Standard* *To be developed*	30

MODULE MEC321: PLASTIC AND FIBREGLASS (continued)

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• identify types of fibreglass material and repair procedures	• ability to identify three kinds of fibreglass material and related resins/hardeners: – describe procedures necessary for repair. *Assessment Tool* *Report Assessment Form, MEC REP 2* *Standard* *To be developed*	10
• do a fibreglass repair	• observed performance in the completion of a repair: – using safe handling techniques – proper preparation of repair area – correct application of material – following approved finishing steps. *Assessment Tool* *Task Assessment Checklist, MEC TSK 4* *Standard* *To be developed*	35
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal interaction during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
	The student should:	
Safety and Environmental Concerns	• follow accepted safety practices when working with hot liquids, plastic solvents, resins and equipment.	WHMIS Ventilation.

MODULE MEC321: PLASTIC AND FIBREGLASS (continued)

Concept	Specific Learner Expectations	Notes
Identification	*The student should:* • identify and state characteristics of plastics used in vehicle manufacture • identify plastics that can be welded and those that can be bonded • know the types of plastic welding equipment available and when this repair process should be used • identify welding rods • know which adhesives are available and their application	
Problem Solving	• after identifying plastic, determine whether to weld or bond • state why a particular process was chosen.	
Preparation	• determine correct layout • prepare "witness lines" for repeat layout • prepare/clean plastic material as per instructions for process used.	
Repair Plastic	• create a solid lay-up • weld material • bond material.	
Repair Fibreglass	• prepare damaged area • prepare material • apply material.	
Career Exploration	• research how prevalent plastic repairs are in industry.	

MODULE MEC322: GLASS REMOVAL AND INSTALLATION

Level: **Advanced**

Theme: **Suspension and Structural Systems**

Prerequisite: **Trim Removal and Installation (MEC218; recommended)**

Module Parameters: **Access to glass removal tools, related materials/resources and glazed vehicles**

Students gain knowledge, skill and practice related to vehicle glass installation and adjustment.

Curriculum and Assessment Standards

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• safely handle glass and related materials	• observed performance related to: – clean-up/disposal of damaged glass – safety procedures required – proper handling of installation materials. *Assessment Tool* *Safety–Care Checklist, MEC SAF 1* *Standard* *To be developed*	10
• identify various techniques used to retain glass	• presentation of a report describing: – glass retaining systems – molding and seals – glass types and functions of glass. *Assessment Tool* *Report Assessment Form, MEC REP 2* *Standard* *To be developed*	15
• show knowledge of tools and procedures used by glass technicians	• observed performance related: – tool identification and use – following instructions as given by specific manufacturer's manuals – proper installation and testing procedures. *Assessment Tool* *Task Assessment Checklist, MEC TSK 4* *Standard* *To be developed*	20

MODULE MEC322: GLASS REMOVAL AND INSTALLATION (continued)

Module Learner Expectations	Assessment Criteria and Conditions (Draft)	Suggested Emphasis
The student will:	*Assessment of student assessment will be based on:*	
• complete several glass removal installations and adjustments	• observed performance in completion of: – front or rear glass removal/replacement – side glass removal/installation adjustment – sealing and testing installation performed. *Assessment Tool* *Problem-solving Assessment Tool, MEC PRO 5* *Standard* *To be developed*	55
• demonstrate effort to develop basic competencies.	• observations of individual effort and interpersonal interaction during the instructional period. *Assessment Tool* *Basic Competencies Reference Guide (CTS BSC 6) and any assessment tools noted above*	Integrated throughout

Concept	Specific Learner Expectations	Notes
Safety and Environmental Concerns	*The student should:* • identify safety concerns when working with glass • show knowledge of safety procedures needed in glass removal • identify installation product safety concerns in the glass industry.	
Glass Removal	• identify types of glass and retaining systems used in auto industry • outline the removal procedures required for different systems • remove glass following safety guidelines • show knowledge of trim parts used around glass.	

MODULE MEC322: GLASS REMOVAL AND INSTALLATION (continued)

Concept	Specific Learner Expectations	Notes
Glass Installation	*The student should:* • identify molding retainers, glass seal products and procedures for installation • install several glass systems, including door glass and side lights.	Refer to manufacturer's specifications for front and rear glass installations to provide vehicle integrity.
Adjustments	• identify door glass adjustment methods • adjust door glass on several different systems.	
Career Exploration	• identify further education and work opportunities related to vehicle glass removal and installation.	

MECHANICS

ASSESSMENT TOOLS

(DRAFT)

ASSESSMENT TOOLS

MECHANICS

Table of Contents

Basic Competencies Reference Guide---------- CTS BSC 6

Safety-Care Checklist ---------- MEC SAF 1

Report Assessment Form---------- MEC REP 2

Introductory Project---------- MEC IPJ 3

Task Assessment Checklist---------- MEC TSK 4

Problem-solving Assessment Tool---------- MEC PRO 5

Date: _____	Class: _____	Student Name: _____
Basic Competencies Reference Guide	Activity: _____	Module: _____

Directions:
The following basic competencies (KSAs) are integrated throughout the CTS program. A student's performance and growth should be assessed through observations involving the student, the teacher, peers and others. As the student progresses through the levels, he or she builds on competencies gained in earlier levels.

	Basic Competency	Stage 1	Stage 2	Stage 3
Personal Management	Managing Learning	*The student will:* ☐ be able to identify/locate appropriate reference/ information sources ☐ identify and demonstrate a variety of learning skills and tools: e.g., learning styles/ preferences and strategies such as notemaking, concept mapping.	*The student will:* ☐ apply a variety of learning styles/preferences to enhance ability to acquire new information recall and apply knowledge	*The student will:* ☐ draw and defend conclusions from available information ☐ extract rules or principles ☐ apply rules and principles to new situations
	Being Innovative	☐ recognize opportunities and problems ☐ specify goals and constraints ☐ generate alternatives ☐ consider risks ☐ evaluate and select best alternative	☐ think critically and act logically to evaluate situations, solve problems and make decisions	☐ combine ideas or information in new ways ☐ make connections between seemingly unrelated ideas ☐ prepare, validate and implement plans that reveal new possibilities
	Ethics	☐ identify appropriate ethical behaviour	☐ demonstrate appropriate ethical behaviour	☐ encourage and support others to demonstrate ethical behaviour
	Managing Resources	☐ allocate time effectively by selecting relevant, goal-related activities, ranking them in order of importance, allocating time and preparing and following schedules	☐ allocate materials and use facilities effectively by acquiring, storing and distributing materials, supplies, parts, equipment, space or final products in order to make best use of them	☐ allocate human and other resources effectively by assessing knowledge and skills, distributing work and materials, evaluating performance and providing feedback
Social Interactions	Communication	☐ prepare and effectively present accurate, concise written, visual and oral reports	☐ communicate thoughts, feelings, and ideas to justify or challenge a position by encouraging, persuading, convincing or otherwise motivating individuals or groups	☐ negotiate effectively by working towards an agreement that may involve exchanging specific resources or resolving divergent interests
	Teamwork, Leadership and Service	☐ participate as an effective member of a team by working cooperatively with others and contributing ideas, suggestions and effort ☐ recognize and respect peoples diversity and individual differences	☐ serve clients and customers effectively by listening carefully to understand their needs and by providing as much assistance as possible to satisfy their expectations	☐ lead when appropriate, mobilizing the group for high performance
	Demonstrating Responsibility (Safety and Accountability)	☐ demonstrate high standards in attendance and punctuality ☐ be trustworthy and honest in dealing with others ☐ follow safe procedures consistently and recognize and eliminate potential hazards	☐ understand and evaluate the impact on self and the organization for breaking with organizational or societal values and regulations	☐ work hard to excel at setting and meeting goals, doing tasks, setting high standards and paying attention to important details

SAFETY - CARE CHECKLIST	Date:_____ Module Learner Expectations: _____ _____	Student Name:_____ Module: _____

Excellence ↓ *Below Standard*

Check the level of performance using the following standards:

4. Exceeds expectations consistently, in an exemplary manner.
3. Shows extra effort with strong consistent performance.
2. Indicates good performance, indicating growth and understanding.
1. Rudimentary level of performance showing limited experience/knowledge.
0. Unacceptable level of performance, not meeting societal expectations.

N/A Does not apply.

CRITERIA		Rating					
		4	3	2	1	0	N/A
PERSONAL	– hygiene – dress, hair, use of jewelery – use of protective equipment	☐	☐	☐	☐	☐	☐
OTHERS	– are considered for their safety – are considered by protecting their environment – are considered through personal sacrifices of time and effort	☐	☐	☐	☐	☐	☐
EQUIPMENT/ TECHNOLOGY	– safety features/procedures are adhered to – potential hazards are recognized – when task complete, is cleaned/stored/ready for reuse	☐	☐	☐	☐	☐	☐
FACILITY	– following shop/lab routines – does their share of clean-up – contributes to the general appearance	☐	☐	☐	☐	☐	☐
OTHER'S PROPERTY	– treated with care and respect – materials are selected/used/stored/disposed of properly	☐	☐	☐	☐	☐	☐
VALUES	– that reflect business/industry workplace	☐	☐	☐	☐	☐	☐

REPORT ASSESSMENT FORM **(written, oral, demonstration)**	Date:_____ Activity: _____ _____ _____	Student Name:_____ Module(s): _____

Excellence ↓ *Below Standard*

Check the level of performance using the following standards:

4. More than met the objectives independently, exceeded standards in quality and scope.
3. Completed task independently. No errors or deficiencies, consistently met the standard.
2. Met objectives with limited assistance. Minor errors/deficiencies noted. Standard of quality is occasionally inconsistent.
1. Completed, demonstrating rudimentary performance level.
0. Not completed, major deficiencies and/or errors evident.

N/A Does not apply.

CRITERIA		Rating					
		4	3	2	1	0	N/A
PLANNING ↓	– understood objective – shows personal initiative	☐	☐	☐	☐	☐	☐
INFORMATION RETRIEVAL ↓	– located appropriate resources – used varied resources – used appropriate number of resources	☐	☐	☐	☐	☐	☐
INFORMATION PROCESSING ↓	– clear introduction, body and conclusion – logical sequencing – organized ideas	☐	☐	☐	☐	☐	☐
INFORMATION SHARING	– covered the scope of the topic – use of appropriate technical terms/ideas – drew appropriate conclusions	☐	☐	☐	☐	☐	☐

Introductory Project	Date: _____ Concept Vehicle: _____ _____ _____	Student Name:_____ Module: _____

Excellence ↓ *Below Standard*

Check the level of performance using the following standards:

4. Exceeds expectations in an exemplary manner.
3. Shows extra effort with strong performance.
2. Indicates good performance, indicating growth, understanding with a good effort.
1. Rudimentary level of performance showing limited experience/knowledge and effort, but meeting personal expectations.
0. Unacceptable level of performance, not meeting personal and societal expectations.

N/A Not applicable.

CRITERIA		Rating					
		4	3	2	1	0	N/A
RESEARCH ↓	– appropriate resources – varied resources – planned ideas	☐	☐	☐	☐	☐	☐
DESIGN ↓	– sketches - shows what the product may look like – drawings - detail and accuracy – workable - can be used for construction	☐	☐	☐	☐	☐	☐
CONSTRUCTION ↓	– use of basic hand tools – use of power tools – use of materials – project assembly	☐	☐	☐	☐	☐	☐
PRODUCT EVALUATION ↓	– workability - appropriate power source, and body for intended use – durability - for intended use – cost effectiveness	☐	☐	☐	☐	☐	☐

Date: _____	Class: _____	Student Name: _____
Task Assessment Checklist	Activity: _____ _____ _____	Module: _____

Excellence ↓ *Below Standard*

Check the level of performance using the following standards:

4. Met task objectives in an exemplary manner, quality and productivity exceeds the standard.
3. Met task objectives independently, no errors or deficiencies, quality and productivity meets the standard.
2. Met task objective with limited assistance, minor errors/deficiencies. Met standard of quality and productivity.
1. Completed task at a rudimentary level following a guided course of action, required some assistance.
0. Incomplete task, major deficiencies and/or errors evident.
N/A Not applicable.

CRITERIA		Rating					
		4	3	2	1	0	N/A
BEGINNING ↓	– understood the task – understood theoretical concepts – prepared for the task (resources/analysis of task)	☐	☐	☐	☐	☐	☐
TASK ↓	– selection and use of basic tools – power tool use – specialized equipment use – effective use of time/organized activity – working with others/communicates/listens	☐	☐	☐	☐	☐	☐
COMPLETION ↓	– outcome - met desired outcomes – problem solving / logical approaches used – innovative – workplace prepared for next activity	☐	☐	☐	☐	☐	☐

Problem Solving Assessment Tool	Date: _____ Activity: _____ _____ _____	Student Name: _____ Module: _____

Excellence ↓ *Below Standard*

Check the level of performance using the following standards:

4. More than met the objectives independently, exceeded standards in quality and scope.
3. Completed task independently. No errors or deficiencies, consistently met the standard.
2. Met objectives with limited assistance. Minor errors/deficiencies noted. Standard of quality is occasionally inconsistent.
1. Completed, demonstrating rudimentary performance level.
0. Not completed, deficiencies and/or errors evident.

N/A Not applicable.

CRITERIA		Rating					
		4	3	2	1	0	N/A
PROBLEM ↓	– defines the problem	☐	☐	☐	☐	☐	☐
INFORMATION RETRIEVAL ↓	– used appropriate resources/tools to understand problem – generated ideas	☐	☐	☐	☐	☐	☐
SELECTED IDEAS ↓	– able to block diagram the problem – appropriate idea selection – able to communicate ideas to others	☐	☐	☐	☐	☐	☐
SOLUTIONS ↓	– able to narrow possibilities – able to settle on one solution	☐	☐	☐	☐	☐	☐
EVALUATE ↓	– tried the solution – made adjustments as needed	☐	☐	☐	☐	☐	☐

LINKAGES/TRANSITIONS

The Mechanics strand supports many of the competencies developed in other CTS strands as well as core or other complementary programs. Competencies developed within the Mechanics strand support a wide range of transitions into the workplace or related post-secondary programs.

LINKAGES

Within CTS

There are direct and indirect linkages with most strands, particularly where understanding and maintenance of equipment/technology are involved. The following represents linkages with other strands:

Agriculture	Landscape and Turf Management, maintenance and safety check on equipment Applications of Agriculture Technology - research applications of technology in agriculture production, processing or marketing
Career Transitions	Safety, job preparation, job maintenance modules Use of project modules to enhance competencies directly or indirectly related to Mechanics
Community Health	First Aid certification
Communications	Study of equipment and maintenance required in communication/printing industry
Construction Technologies	Tool and machine maintenance module Electrical Systems module
Design Studies	Appropriate and effective design solution, particularly as it applies to Modes and Mechanisms module
Enterprise and Innovation	Student identifying opportunities and developing future plans related to Mechanics strand
Electro-Technologies	Electrical/Electronics knowledge and skills that apply to vehicles
Fabrication Studies	Welding/cutting/heating processes used in mechanics, particularly in Auto Body restoration Principles of sheet metal fabrications Principles and practices in machining
Financial Management	Recognizing the need and developing skills in financial management necessary for successful business in Mechanics-related areas
Foods	The maintenance and service skills required for foods-related equipment
Forestry	Career opportunities related to service of Forestry-related equipment
Fashion Design	Knowledge and skills required for vehicle upholstery
Information Processing	Use/understanding of software use Understanding of various information processing tools and processes
Tourism	Research land, air and sea transportation vehicles as used in tourism and career opportunities in maintenance and service

Note that the project modules from the Career Transitions strand may be combined with modules from Mechanics strand to provide increased opportunities for students to develop expertise and refine their competencies in a particular module(s). For example, the project modules could enhance the following:

- engine rebuilding
- complete vehicle brake work
- complete suspension reconditioning
- extensive collision work.

To Other Secondary Programs

Refer to charts in this section for examples of linkages with other secondary programs.

TRANSITIONS

To The Workplace

The National Occupational Classification (NOC) and Provincial Occupational Profile (POP) chart in this section indicates occupations for which Mechanics provides a foundation high school students could potentially move into.

CORRELATION OF CTS MECHANICS TO JUNIOR AND SENIOR HIGH SCHOOL MATHEMATICS COURSES

MECHANICS		SCIENCE			ACTIVITY
Module	**Objective/Concept**	**Course**	**Unit**	**Concept/Skill**	
MEC101 Modes and Mechanism	Research and design a transportation vehicle for specific need and application. Use tools and materials in an appropriate fashion to construct and test the performance of a vehicle for its intended use.	Math 7 Math 8 Math 9		Constructs geometric designs using tools such as a computer, compass, straightedge ruler or mira. Maintains previously developed skills (linear, area, volume, capacity, mass units of measure; classification of polygons: perimeter and area of polygons and the circle; volume of a right rectangular prism and cube). Use the formula $A=\pi r^2$ to determine indirectly, the area of a circle given its radius or diameter. Manipulates a given formula to change the subject of the formula. Express equivalent measures of SI units (linear).	Plan, design, CO_2 car to specs. Building CO_2 car to specifications, test speed using formula distance/time. Research, design, or build alternative produced vehicles, i.e., hovercraft.
MEC102 Vehicle Care	Create a service schedule for a vehicle as a means of preventive maintenance. Inspect and service a vehicle as outlined in the vehicle service schedule	Math 7 Math 8-9	•Ration and Proportion •Data Management	Demonstrates a knowledge and understanding of the use and purposes of statistics as it affects daily living. Collects and records data (tally sheets and frequency tables) Compare two quantities using ratios in the form a/b and a to b.	Itemize needed services to the vehicle according to the specifications laid out in the service manual. Using information from the manual, design a spread sheet that outlines both short and long term maintenance. Include in the spread sheet, estimated costs inventory and annual expenses related to vehicle maintenance. Perform needed service maintenance to the vehicle as outlined in the service schedule.

CORRELATION OF CTS MECHANICS TO JUNIOR AND SENIOR HIGH SCHOOL MATHEMATICS COURSES

MECHANICS		SCIENCE			ACTIVITY
Module	**Objective/Concept**	**Course**	**Unit**	**Concept/Skill**	
MEC104 Engine Fundamentals	Analyze and compare the operating principles of common engines.	Math 7-8-9	•Ration •Volume •Displace-ment	Number Systems and Operations, Whole Numbers, Decimals, Measurement and Geometry, Data Management, Ratio and Proportion.	With the aid of proper modules and diagrams, compare operating principles of the internal combustion engine as it compares to the diesel and rotary engines. Compare compression ratios, engine displacement and various fuel systems.
		Math 8	•Measure-ment •Data Management	Rational Numbers, ratio and Proportions, Measurement and Geometry, Data Management.	
		Math9	•Measure-ment	Number Systems and Operations, Ratio Proportion Measurement and Geometry.	Using a variety of measuring devices, i.e., sliding, calliper, micrometer, telescoping and feeler gauges, dial indicators, determine the condition of various engine components as they relate to proper engine specifications.

CORRELATION OF CTS MECHANICS TO JUNIOR AND SENIOR HIGH SCHOOL SCIENCE COURSES

MECHANICS		SCIENCE			ACTIVITY
Module	**Module Learner Expectations**	**Crs**	**Unit**	**Concept/ Skill**	
MEC101	• planning and designing a transportation vehicle • understand propulsion systems • forces to be overcome in the motion of a vehicle	Sc8	Energy and Machines	Concepts 2, 3, 5	• construct models to demonstrate the scientific principles.
		Sc10	Energy and Change	Concept 1 and 2	
		Sc14	Understanding Technology	Concept 1.2	
		Sc16	Technology at Work	Concepts 2, 3, 4, 5	
		Sc20	Changes in Motion	Concept 1 and 4	• scale drawings and numerical calculations • algebraic and graphic representations
		Ph20	Kinematics and Dynamics	Concept 1	
		Sc24	Safe Transportation	Concepts 1.1-4	
		Sc26	Technology at Work	Concepts 1.1, 1.2, 1.4	
		Ph30	Conservation Laws	Concepts 1 and 2	
MEC102	• Care and service of a motor vehicle • Vehicle storage and shelter	Sc9	Chemical Properties and Change	Concepts 5, 6	• investigate the reaction of salt and water on unprotected metal • illustrate examples of corrosion
		Sc10	Matter and Energy in Climatal Change	Concept 3.1	
		Sc20	Chemical Changes	Concept 3.1	
		Sc24	Safe Transportation	Concept 3.4	
		Sc26	Technology at Work	Concept 3	

CORRELATION OF CTS MECHANICS TO JUNIOR AND SENIOR HIGH SCHOOL SCIENCE COURSES

MECHANICS		SCIENCE			ACTIVITY
Module	**Module Learner Expectations**	**Crs**	**Unit**	**Concept/ Skill**	
MEC102 (continued)		Ch20	Chemical Bonding in Matter	Concept 1	• experiments related to the activity series of metals
		Ch30	Electro-chemical Changes	Concept 2	
MEC104	Engine fundamentals and the principles of internal and external combustion engines	Sc7	Force and Motion	Concept 1	
		Sc8	Energy and Mechanics	Concept 1	
		Sc10	Matter and Energy in Chemical Change	Concepts 1, 2, 3, 4	• experiments to demonstrate energy involvement in the change of matter
		Sc14	Understanding Technology	Concepts 3, 4	
		Sc16	Technology at Work	Concepts 2, 3, 4, 5, 6	
		Sc16	Understanding the Environment	Concepts 3, 5, 6 and 7	
MEC109	• methods of producing electricity • understanding basic electrical circuit drawings • knowing basic electrical terminology	Sc9	Electro-Magnetic Systems	Concepts 3, 4, 5	• construct a simple electrical source • construction of a simple electro- construction of a simple electro-magnetic or St. Lewis motor
		Sc16	Technology at Work	Concept 2, 3	
		Sc26	Technology at Work	Concept 1, 2	
		Sc26	Understanding our Environment	Concepts 1, 2, 6	
		Sc30	Electro-magnetic Energy	Concepts 1, 2, 3, 4	

CORRELATION OF CTS MECHANICS TO JUNIOR AND SENIOR HIGH SCHOOL SCIENCE COURSES

MECHANICS		SCIENCE			ACTIVITY
Module	**Module Learner Expectations**	**Crs**	**Unit**	**Concept/ Skill**	
MEC109 (continued)		Sc30	Energy and the Environment	Concept 1	
		Ph30	Nature of the Atom	Concepts 1, 4	
		Ph30	Magnetic Forces and Fields	Concepts 1, 2, 3	
		Ph30	Electric Forces and Fields	Concepts 1, 2, 3, 4	
MEC110		Sc7	Forces and Motion	Concept 1	
MEC111	• pneumatic and hydraulic symbols and circuit drawings • use of pneumatics and hydraulics to change size direction and location of fluid force • relationship between flow rate and process	Sc9	Fluids and Pressure	Concepts 1, 2, 3, 4	• construct valves • assemble tubing to observe flow rate and pressure
MEC113	• identification of mechanisms that change size, direction, and location of mechanical force • understand the co-efficient of friction • mechanical energy can be changed	Sc8	Energy and Mechanics	Concepts 2, 4, 5	• design and construct a simple machine to perform a task • identify tools and devices that redirect mechanical force • perform experiments to demonstrate the force of friction • calculate the mechanical advantage of a machine

CORRELATION OF CTS MECHANICS TO JUNIOR AND SENIOR HIGH SCHOOL SCIENCE COURSES

MECHANICS		SCIENCE			ACTIVITY
Module	**Module Learner Expectations**	**Crs**	**Unit**	**Concept/ Skill**	
MEC113 (continued)		Sc10	Energy and Change	Concept 1, 2, 4	• illustrate examples of mechanical energy • perform and experiment to convert mechanical energy to heat energy
		Sc14	Understanding Technology	Concepts 2, 3, 4	• illustrate examples of scientific principles in modern devices
		Sc16	Technology at Work	Concepts 1 - 6	
		Ph20	Kinematics and Dynamics	Concept 3	• perform experiment investigating the relationship among mechanical energy, work and power
		Ph30	Conservation Laws	Concept 1	
MEC116	• identification and strategies used in the design and the determination of materials used in vehicle construction • structural coating • recycling of materials	Sc7	Structure and Design	Concepts 3, 4, 5, 6	• design and construct a model vehicle • provide examples of material coatings
		Sc16	Technology at Work	Concepts 5, 6	• identify vehicle components which may be recycled
		Sc16	Understanding Our Environment	Concepts 5, 6, 7	• example of the components of a vehicle that may be recycled
		Sc24	Materials and Products	Concepts 1 - 6	
		Sc30	Chemistry in the Environment	Concept 1	

POTENTIAL OPPORTUNITIES FOR TRANSITION INTO THE WORKPLACE/POST SECONDARY PROGRAMS

Occupational Profile	NOC/POP	A	B	C	D
Agriculture Mechanic/Farm Equipment Mechanics	POP		T/✓	✓	
Aircraft Maintenance Engineers	POP	✓		✓	
Appliance Servicemen	POP		T/✓	✓	
Assemblers, Fabricators and Inspectors, Industrial Electrical Motors and Transformers	NOC	✓		✓	
Auto Body Mechanics	POP		T/✓	✓	
Automotive Mechanical Installers and Servicers	NOC	✓			
Carmen	POP	✓			
Construction Millwright and Industrial Mechanics (except Textile)	BOTH		T/✓	✓	
Contractors and Supervisors, Mechanic Trades	NOC		T/✓	✓	
Electronic Assemblers, Fabricators, Inspectors and Testers	NOC	✓			
Elevator Constructors and Mechanics	NOC		T/✓	✓	
Heavy Duty Equipment Mechanics	BOTH		T/✓	✓	
Industrial Instrument Technicians and Mechanics	BOTH		T/✓	✓	
Machine Fitters	NOC		T/✓	✓	
Machine Operators and Inspectors, Electrical Apparatus Manufacturing	NOC	✓			
Machinists and Machining and Tooling Inspectors	NOC		T/✓	✓	
Maintenance Managers	NOC			✓	✓
Manufacturing Managers	NOC			✓	✓
Mechanical Assemblers and Inspectors	NOC	✓			
Mechanical Engineers	BOTH				✓
Mechanical Engineering Technologists	POP			✓	
Motor Mechanics	NOC		T/✓		
Motorcycle Mechanics	BOTH		T/✓		
Motor Vehicle Body Repairs	NOC		T/✓	✓	
Motor Vehicle Mechanics, Technicians and Mechanical Repairers	NOC		T/✓	✓	
Oil and Solid Fuel Heating Mechanics	NOC		T/✓	✓	
Other Small Engine and Equipment Mechanics	NOC		T/✓	✓	
Other Trades and Related Occupations	NOC		T/✓	✓	
Other Trades Helpers and Labourers	NOC	✓			
Partsmen	POP		T/✓	✓	
Power Engineers	POP				✓
Refrigeration and Air Conditioning Mechanics	BOTH		T/✓	✓	
Recreation Vehicle Mechanics	POP		T/✓	✓	
Storekeepers and Parts Clerks	NOC	✓		✓	

Occupational Profile	NOC/POP	A	B	C	D
Supervisors, Machinists and Related Occupations	NOC		T/✓	✓	
Supervisors, Motor Vehicle Assembling	NOC	✓			
Supervisors, Other Mechanical and Metal Products Manufacturing	NOC	✓			
Textile Machinery Mechanics and Repairers	NOC	✓			
Tool and Die Makers	NOC		T/✓	✓	
Transportation Refrigeration Mechanic	POP		T/✓	✓	

A—High School Education
B—Apprenticeship
C—College or Vocational Education
D—University

Career and Technology Studies:
Potential Linkages with Alberta's Apprenticeship Trades

	Trade	CTS Strands												Enhancement Modules		
		Agriculture	Communication Technology	Construction Technologies	Cosmetology	Design Studies	Electro-Technologies	Energy & Mines	Fabrication Studies	Fashion Studies	Foods	Management & Marketing	Mechanics	Career Transitions	Enterprise & Innovation	Work Experience
High Degree of Alignment With Apprenticeable Trades	Agricultural Mechanic	▒					▒		▒				■			
	Autobody Mechanic								▒				■			
	Baker										■					
	Cabinetmaker			■												
	Carpenter			■		▒										
	Communication Electrician		▒				■									
	Cook										■					
	Electrician			▒			■									
	Electronic Technician						■									
	Hairstylist				■											
	Heavy Duty Mechanic						▒		▒				■			
	Landscape Gardener	■		▒		▒						▒	▒			
	Machinist					▒			■				▒			
	Motorcycle Mechanic						▒		▒				■			
	Motor Mechanic						▒		▒				■			
	Printing & Graphic Arts Craftsman		■			■	▒			▒						
	Sheet Metal Worker					▒			■							
	Tool & Die Maker					▒			■							
	Welder						▒		■				▒			
Partial Alignment With Apprenticeship Trades	Appliance Serviceman						▒						▒			
	Boilermaker							▒	▒							
	Bricklayer			▒												
	Cement Finisher			▒												
	Crane & Hoisting Equipment Operator			▒				▒								
	Electrical Rewind Mechanic						▒									
	Elevator Constructor								▒							
	Floorcovering Installer			▒												
	Gasfitter								▒							
	Glassworker					▒										
	Instrument Mechanic						▒									
	Insulator			▒												
	Ironworker								▒							
	Lather-Interior System Mechanic			▒												
	Millwright						▒		▒				▒			
	Painter & Decorator			▒		▒				▒						
	Partsman						▒						▒			
	Plasterer			▒												
	Plumber			▒												
	Power Lineman						▒									
	Power System Electrician						▒									
	Projectionist		▒				▒									
	Recreation Vehicle Mechanic			▒			▒		▒				▒			
	Refrigeration & Air Conditioning Mechanic			▒			▒						▒			
	Roofer			▒												
	Sawfiler			▒												
	Circular Sawfiler			▒												
	Sprinkler Systems Installer								▒							
	Steamfitter-Pipefitter							▒	▒							
	Structural Steel and Plate Fitter								▒							
	Tilesetter			▒												
	Transport Refrigeration Mechanic												▒			
	Water Well Driller							▒								

CTS Strands - that deliver many of the competencies / program defined in the first period of the apprenticeship program
CTS Strands - that deliver some of the competencies / program defined in the first period of the apprenticeship program

LINK#5.XLS
4/3/95

CAREER & TECHNOLOGY STUDIES

MECHANICS

LEARNING RESOURCE GUIDE

INTERIM 1995
(SEPTEMBER 1995 - SEPTEMBER 1997)

Alberta
EDUCATION

MAY 1995

CURRICULUM STANDARDS BRANCH

Comments and suggestions are welcome and should be directed to:

Career and Technology Studies Unit
Alberta Education
Curriculum Standards Branch
11160 Jasper Avenue
Edmonton, AB
T5K 0L2
Telephone: 422-4872
Fax: 422–5129

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INTRODUCTION

CTS AND THE RESOURCE-BASED CLASSROOM

Career and Technology Studies (CTS) encourages teachers to establish a resource-based classroom, where a variety of appropriate, up-to-date print and non-print resources are available. Learning resources identified for CTS strands include print, software, interactive videos, manipulatives, student learning guides and tutorials.

The resource-based classroom approach accommodates a variety of instructional strategies and teaching styles, and supports individual or small group planning. It provides students with opportunities to interact with a wide range of information sources in a variety of learning situations. Students in CTS are encouraged to take an active role in managing their own learning. Ready access to a strong resource base enables students to learn to screen and use information appropriately, to solve problems, to meet specific classroom and learning needs, and to develop competency in reading, writing, speaking, listening and viewing.

PURPOSE AND ORGANIZATION OF THIS DOCUMENT

The purpose of this document is to help teacher identify a variety of resources to meet their needs and those of the students taking the new Mechanics curriculum. It is hoped that this practical guide to resources will help teachers develop a useful, accessible resource centre that will encourage students to become independent, creative thinkers.

This document is organized as follows:

- Authorized Resources
  - basic learning resources
  - support learning resources
  - teaching resources
- Other Resources
- Additional Sources.

Some resources in the guide have been authorized for use in some or all of the CTS strands, e.g., the 11 video Career and Technology Studies series produced by ACCESS Network. Full information is provided in the appropriate section of this resource guide.

Each resource in the guide provides bibliographic information, an annotation where appropriate, and a correlation to the Mechanics modules. The distributor code for each entry will facilitate ordering resources. It is recommended that teachers preview all resources before purchasing, or purchase one copy for their reference and additional copies as required.

Distributor Code	Resources	Levels/Mod. No.		
		1	2	3
ATEC	Author / Title	101	201	301
	Bibliographic Information			
	Annotation			

1 = Introductory Level
2 = Intermediate Level
3 = Advanced Level

← Indicates module number

Distributor Code -See Distributor Directory

HOW TO ORDER

Most authorized resources are available from the Learning Resource Distributing Centre (LRDC) at:

12360 - 142 Street
Edmonton, AB
T5L 4X9
Telephone: 427-2767
Fax: 422-9750

Purchase order numbers have been provided (where possible) for resources available through the LRDC. The section on Additional Sources lists a variety of other places to find information related to this strand. In addition, at the back of this document is a Distributor Directory, which contains the name and address of each publisher/distributor referred to in the resource list. Note that in some cases a resource may be published by one company but distributed through another.

The information contained is as complete and accurate as possible.

RESOURCE POLICY

For further information on resource policy and definitions, refer to the *Student Learning Resources Policy* and *Teaching Resources Policy* or contact:

Learning Resources Unit
Curriculum Standards Branch
Alberta Education
5th Floor, Devonian Building, East Tower
11160 Jasper Avenue
Edmonton, AB
T5K 0L2
Telephone: 422-4872
Fax: 422-5129

AUTHORIZED RESOURCES

BASIC LEARNING RESOURCES

The following basic learning resources have been authorized by Alberta Education for use in the Mechanics curriculum. These resources address the majority of the learner expectations in one or more modules and/or levels. A curriculum correlation appears in the right-hand column.

Distributor Code	Resources	Levels/Module No.		
		1	2	3
LRDC	*Auto Body Repair and Finishing*. John W. Hogg. McGraw-Hill Ryerson, 1988. Text. Introduces vehicle body repair; includes of practical and theoretical aspects required in the repair industry.	109 116 117 119	215 216 217 218 219 220 222	319 321
LRDC	*Car Care Book, The*. Fred Barbarossa and G. Bono Savero. Nelson Publishers, 1988. Text. Supports a general interest in mechanics. Reading level and content correlates well with introductory modules.	102 104 109 111 113 115	202	301 302
LRDC	*Modern Automotive Technology*. James E. Duffy. Irwin Publishing, 1994. Text. Covers most vehicle areas; current and at appropriate reading levels; teacher and student support materials available.	101 102 104 109 115	202 203 204 206 207 209 210 211 212 213 214 215 216	303 304 305 306 307 309 311 312 313 314 315
LRDC	*Motor Auto Body Repair*. Robert Scharff. Nelson Publishing, 1992. Text. Covers auto body repair, with excellent diagrams and resources.	116 117 119	217 218 219 220 221	316 317 318 319 320 321 322

SUPPORT LEARNING RESOURCES

The following support learning resources are authorized by Alberta Education to assist in addressing some of the learner expectations of a module or components of modules.

Distributor Code	Resources	Levels/Module No.		
		1	2	3
LRDC	*Auto Electricity, Electronics, Computers.* James Duffy. Goodheart-Willcox Co. Inc., 1989. Text and Student Workbook. Provides principles, diagrams, testing and repair of major electrical/electronic systems on a vehicle. Workbook has 28 chapters of electrical-electronic principles, diagrams, testing with sample ASE questions.	109	206 209	303 304 308 309 310 311
LRDC	*Auto Engines.* James Duffy and John Hurt. Goodheart-Willcox Co. Inc., 1988. Text and Student Workbook. In-depth coverage of engine principles, diagnosis and service. Workbook contains 30 chapters of short answer questions related to engines with sample ASE questions and suggested activities.	104 109	202 203 204 205 207 209	303 304 305 306 307
LRDC	*Auto Fuel and Emission Control Systems.* James Duffy and J. Smith. Goodheart-Willcox Co. Inc., 1992. Text and Student Workbook.. Covers fuel and emission control systems and is supplemented by the workbook.		204 207	303 304
LRDC	*Auto Shop Safety.* Meridan. Video. Features auto shop safety at the introductory level.	102 104 109 111 113		
LRDC	*Automatic Transmissions.* Sheldon L. Abbott. Glencoe Publishing Company, 1989. Text and Lab Manual. Covers theory, diagnosis, in-car service and overhaul of automatic transmissions including transaxles.		202	313
LRDC	*Automotive Air Conditioning and Heating.* Ivan Hinerman and Thomas Birch. Glencoe Publishing Company, 1987. Text and Lab Manual. Covers air conditioning and heating.		202	311

Support Learning Resources (Cont'd.)

Distributor Code	Resources	Levels/Module No. 1	2	3
LRDC	*Automotive Technology - A Systems Approach*. Jack Erjavee and Robert Scharff. Delmar Publishers, 1992. Text, Student Workbook and *Tech Manual*. A comprehensive resource covering many of the modules. Has excellent illustrations with many coloured diagrams. Supporting material, workbook and test banks on computer disc.	102 104 109 111 115	202 203 204 206 207 209 210 211 212 213 214 215 216	303 304 305 306 307 309 310 311 312 313 314 315
ACC	*Career and Technology Studies: Key Concepts*. Edmonton, AB: ACCESS Network. Series of videos and utilization guides relevant to all CTS strands. Series consists of *Anatomy of a Plan, Creativity, Electronic Communication, The Ethics Jungle, Go Figure, Innovation, Making Ethical Decisions, Portfolios, Professionalism, Project Planning, Responsibility* and *Technical Writing*.	all	all	all
LRDC	*Complete Automotive Welding Metals and Plastics*. Robert Scharff and Dave Caruse. Delmar Publishers, 1990. Text. This resource covers welding safety, MIG welding, oxyacetylene, plasma arc, TIG, spot welding, brazing, plastic welding and fibreglass repair techniques.		217	321
LRDC	*Complete Engine Performance and Diagnostic*. Robert Scharff. Delmar Publishers, 1989. Text and Student Technician Manual. Covers engine performance, especially electrical components.		203 204 206 207 209	303 304
LRDC	*Complete Under Car Systems - Steering and Suspension*. Scharf, Robert. Delmar Publishers, 1989. Text and Student Technicians Shop Manual.. Excellent coverage of steering suspension, drive shaft, tires, wheels and under-car inspection. Manual includes questions and job sheets for chapters covered in the text.	115	210 212 215 216	314 315
LRDC	*Engineering Technology: Hydraulics and Pneumatics, Part I and Part II*. Shopware Educational Systems. Computer Discs (6). Covers hydraulic and pneumatic program.	111		
LRDC	*I-Car Unibody Collision Repair*. Delmar Publishers. Text. A comprehensive resource for unibody collision repair.	116 117 119	217 218	317 318 319 320 321 322

Support Learning Resources (Cont'd.)

Distributor Code	Resources	Levels/Module No.		
		1	2	3
LRDC	*Modern Automotive Technology.* James E. Duffy. Irwin Publishing, 1994. Student Workbook. 76 (short answer) content tests and 17 job sheets. See Basic Learning Resources for annotation and correlation.			
LRDC	*Small Gas Engines.* Alfred Roth. Goodheart-Willcox Co. Inc., 1992. Text and Workbook. A good resource for small gas engines.	104	203 204 206	

TEACHING RESOURCES

The following teaching resources are authorized by Alberta Education to assist teachers in the instructional process.

Distributor Code	Resources	Levels/Module No. 1	2	3
LRDC	*Auto Electricity, Electronics, Computers*. James Duffy and N. Henke-Konopasek. Goodheart-Willcox Co. Inc., 1992. Instructor's Guide. See Support Learning Resources for annotation and correlation.			
LRDC	*Auto Engines*. James Duffy. Goodheart-Willcox Co. Inc., 1988. Instructor's Guide. See Support Learning Resources for annotation and correlation.			
LRDC	*Automatic Transmissions*. Sheldon L. Abbott. Glencoe Publishing Co., 1988. Instructor's Guide and Instructor's Manual. See Support Learning Resources for annotation and correlation.			
LRDC	*Automotive Air Conditioning and Heating*. Ivan Hinerman and Thomas Birch. Glencoe Publishing Company, 1988. Instructor's Manual. See Support Learning Resources for annotation and correlation.			
LRDC	*Automotive Technology - A Systems Approach*. Jack Enjavec and Robert Scharff. Delmar Publishers, 1992. Instructor's Guide. See Support Learning Resources for annotation and correlation.			
LRDC	*Car Care Book, The*. Fred Barbarossa and G. Bono Savero. Nelson Publishers, 1988. Instructor's Guide. See Basic Learning Resources for annotation and correlation.	102 104 109 111 113 115	202	301 302
LRDC	*Complete Automotive Welding Metals and Plastics*. Robert Scharff and Dave Caruse. Delmar Publishers, 1990. Instructor's Guide. See Support Learning Resources for annotation and correlation.			
LRDC	*Complete Engine Performance and Diagnostics*. Robert Scharff. Delmar Publish, 1989. Instructor's Guide. See Support Learning Resources for annotation and correlation.			
LRDC	*Complete Under Car Systems - Steering and Suspension*. Robert Scharff. Delmar Publishers, 1989. Instructor's Guide. See Support Learning Resources for annotation and correlation.			

Teaching Resources (Cont'd.)

Distributor Code	Resources	Levels/Module No. 1	2	3
LRDC	*Design and Technology.* Colin Coborn, Ian Mould and John Cave. Nelson Publishing Co., 1989. Text. Provides ideas for Modes and Mechanisms.	101		
LRDC	*I-Car Unibody Collision Repair.* Michael McDermott. Delmar Publishers, 1992. Instructor's Guide. See Support Learning Resources for annotation and correlation.			
LRDC	*Modular Courses in Technology - Mechanisms.* Amay Bailey, Roy Pickup, Ray Lewis and Peter Patient. Oliver and Boyd, 1991. Text. An introductory resource for levers, pulleys, gears, cams, couplings, shafts, bearings and steering.	101 104 113 115		
LRDC	*Motor Auto Body Repair.* Robert Scharff. Delmar Publishers, 1992. Instructor's Guide. See Basic Learning Resources for annotation and correlation.	116 117 119	217 218 219 220 221	316 317 318 319 320 321 322
LRDC	*Today's Technician: Manual Transmissions and Transaxles.* Jack Erjavec. Delmar Publishers, 1994. Shop Manual and Classroom Manual. Shop Manual provides introductory and service information on standard transmissions and transaxles. Classroom Manual provides principles of operation and step-by-step approach for diagnosing and repairing manual transmissions and transaxles.	113	213 214	314

Mechanics Resources

THEME CODE:
A. Vehicle Design & Ownership
B. Energy & Propulstion Systems
C. Control & Transmission Systems
D. Material & Structural Systems
E. Project & Service Work

FORMAT CODE:
P - Print
V - Video
S - Software

STATUS CODE:
B - Basic
S - Support
T - Teaching

LEVEL CODE:
1 - Introductory
2 - Intermediate
3 - Advanced

EQUIPMENT	Format	Status	Junior/Senior High
LEVEL			
THEME			
SPECIAL FACILITIES			
ACCESS Network videos	V	B	J/S
Auto Body Repair and Finishing	P	B	J/S
Auto Electricity, Electronics, Computers. Instructor's Guide	P	T	S
Auto Electricity, Electronics, Computers. Student Workbook	P	S	S
Auto Electricity, Electronics, Computers. Text	P	S	S
Auto Engines. Instructor's Guide	P	T	S
Auto Engines. Student Workbook	P	S	S
Auto Engines. Text	P	S	S
Auto Fuel and Emission Control System. Text	P	S	S
Auto Fuel and Emission Control Systems. Instructor's Manual	P	T	S
Auto Shop Safety	V	S	J/S
Automatic Transmissions	P	S	S
Automatic Transmissions. Instructor's Guide	P	T	S
Automotive Air Conditioning and Heating. Instructor's Manual	P	T	S
Automotive Air Conditioning and Heating. Text & Lab Manual	P	S	S

LEVEL	THEME	SPECIAL FACILITIES	Modes & Mechanisms	Vehicle Care	Engine Fundamentals	Electrical Fundamentals	Pneumatic & Hydraulic Systems	Mechanical Systems	Ride & Control Systms	Vehicle Structures & Materials	Metal Forming and Finishing	Surface Preparation I	Vehicle Detailing	Vehicle Maintenance	Lubrication & Cooling System	Fuel & Exhaust Systems	Alternate Fuel Engines	Ignition Systems	Emission Controls	Electrical Components	Power Assist Accessories	Braking Systems	Hydraulic Accessories	Power Trains	Manual Transmissions	Suspension Systems	Steering Systems	Metal Repair & Finishing	Trim Removal & Installation	Surface Preparation II	Refinishing I	Basic Touch-up & Finishing	Interior Finishes and Repairs	Buying & Selling a Vehicle	Vehicle Value Appraisal	Engine Performance Diagnosis	Engine Tune-up	Engine Removal & Installation	Engine Reconditioning I	Engine Reconditioning II	Alternate Propulsion Systems	Computer Managment Systems	Safety Systems	Climate Control	Power Assisting	Automatic Transmissions	Power Train Repair	Wheel Alignment	Body Repair Estimation	Structural Damage Analysis	Structural Damage Repair I	Structural Damage Repair II	Refinishing II	Plastic & Fibreglass	Glass Removal & Installation
1	A	•	101	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
1	A	•	102	X																																																				
1	B	•	104	X																																																		
1	C	•	109	X		X																																																
1	C	•	111	X																																																		
1	C	•	115	X																																																		
1	D	•	115	X																																																		
1	D	•	116	X						X																																											
1	D	•	117	X						X																																											
1	A	•	119	X						X																																											
2	A	•	201	X																																																	
2	A	•	202	X										X	X	X	X		X	X						X	X	X	X	X						X	X	X	X	X												
2	B	•	203	X										X	X	X	X		X	X						X	X	X	X	X						X	X	X	X	X												
2	B	•	204	X										X	X	X	X		X	X						X	X	X	X	X						X	X	X	X	X												
2	B	•	205	X										X	X	X	X		X	X						X	X	X	X	X						X	X	X	X	X												
2	B	•	206	X										X				X																																				
2	B	•	207	X										X					X	X																																		
2	C	•	209	X										X					X	X																																		
2	C	•	210	X																																																		
2	C	•	211	X																																																		
2	C	•	212	X																																																		
2	C	•	213	X																																																		
2	C	•	214	X																																																		
2	D	•	215	X																						X	X	X	X	X						X	X	X	X	X												
2	D	•	216	X																						X	X	X	X	X						X	X	X	X	X												
2	D	•	217	X																						X	X	X	X	X						X	X	X	X	X												
2	D	•	218	X																						X	X	X	X	X						X	X	X	X	X												
2	D	•	219	X																						X	X	X	X	X						X	X	X	X	X												
2	D	•	220	X																						X	X	X	X	X						X	X	X	X	X												
2	D	•	221	X																																																	
2	D	•	222	X																														X																			
3	A	•	301	X																																																
3	A	•	302	X																																																
3	B	•	303	X																						X	X	X	X	X									X	X	X	X	X												
3	B	•	304	X																						X	X	X	X	X									X	X	X	X	X												
3	B	•	305	X																																																
3	B	•	306	X																																																
3	B	•	307	X																																																
3	B	•	308	X																														X																			
3	C	•	309	X																														X																			
3	C	•	310	X																														X																			
3	C	•	311	X																														X																			
3	C	•	312	X																																																
3	C	•	313	X																																																
3	C	•	314	X																																																
3	D	•	315	X																																																
3	D	•	316	X																																																
3	D	•	317	X																																																
3	D	•	318	X																																																
3	D	•	319	X																																																
3	D	•	320	X																																																
3	D	•	321	X																																																
3	D	•	322	X																																																

Mechanics Resources

THEME CODE:
A. Vehicle Design & Ownership
B. Energy & Propulstion Systems
C. Control & Transmission Systems
D. Material & Structural Systems
E. Project & Service Work

FORMAT CODE:
P - Print
V - Video
S - Software

STATUS CODE:
B - Basic
S - Support
T - Teaching

LEVEL CODE:
1 - Introductory
2 - Intermediate
3 - Advanced

EQUIPMENT	Format	Status	Junior/Senior High
LEVEL			
THEME			
SPECIAL FACILITIES			
Automotive Technology - A Systems Approach. Instructor's Guide	P	T	S
Automotive Technology - A Systems Approach. Student Workbook	P	S	J/S
Automotive Technology - A Systems Approach. Text	P	S	J/S
Car Care Book, The	P	B	J/S
Car Care Book. The Instructor's Guide	P	T	J/S
Complete Automotive Welding Metals and Plastics. Instructor's Guide	P	T	S
Complete Automotive Welding Metals and Plastics. Text	P	S	S
Complete Engine Performance and Diagnostic. Text	P	S	S
Complete Engine Performance and Diagnostics. Instructor'a Guide	P	T	S
Complete Under Car Systems - Steering and Suspension. Instructor's Guide	P	T	S
Complete Under Car Systems - Steering and Suspension. Shop Manual	P	S	S

	101	102	104	109	111	113	113	116	117	119	201	202	203	204	205	206	207	209	210	211	212	213	214	215	216	217	218	219	220	221	222	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322
LEVEL	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
THEME	A	A	B	C	C	C	D	D	D	D	A	A	B	B	B	B	B	C	C	C	C	C	C	C	D	D	D	D	D	D	D	A	A	B	B	B	B	B	B	C	C	C	C	C	C	C	D	D	D	D	D	D	D
SPECIAL FACILITIES	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	Modes & Mechanisms	Vehicle Care	Engine Fundamentals	Electrical Fundamentals	Pneumatic & Hydraulic Systems	Mechanical Systems	Ride & Control Systms	Vehicle Structures & Materials	Metal Forming and Finishing	Surface Preparation I	Vehicle Detailing	Vehicle Maintenance	Lubrication & Cooling System	Fuel & Exhaust Systems	Alternate Fuel Engines	Ignition Systems	Emission Controls	Electrical Components	Power Assist Accessories	Braking Systems	Hydraulic Accessories	Power Trains	Manual Transmissions	Suspension Systems	Steering Systems	Metal Repair & Finishing	Trim Removal & Installation	Surface Preparation II	Refinishing I	Basic Touch-up & Finishing	Interior Finishes and Repairs	Buying & Selling a Vehicle	Vehicle Value Appraisal	Engine Performnce Diagnosis	Engine Tune-up	Engine Removal & Installation	Engine Reconditioning I	Engine Reconditioning II	Alternate Propulsion Systems	Computer Managment Systems	Safety Systems	Climate Control	Power Assisting	Automatic Transmissions	Power Train Repair	Wheel Alignment	Body Repair Estimation	Structural Damage Analysis	Structural Damage Repair I	Structural Damage Repair II	Refinishing II	Plastic & Fibreglass	Glass Removal & Installation
Automotive Technology - A Systems Approach. Instructor's Guide		X	X	X	X	X	X					X	X	X		X	X		X	X	X	X	X	X	X								X	X	X	X	X	X		X	X	X	X	X	X							
Automotive Technology - A Systems Approach. Student Workbook		X	X	X	X		X					X	X	X		X	X	X	X	X	X	X	X	X	X								X	X	X	X	X		X	X	X	X	X	X							
Automotive Technology - A Systems Approach. Text		X	X	X	X		X					X	X	X		X	X	X	X	X	X	X	X	X	X								X	X	X	X	X		X	X	X	X	X	X							
Car Care Book, The		X	X	X	X	X	X					X																			X	X																			
Car Care Book. The Instructor's Guide		X	X	X	X	X	X					X																			X	X																			
Complete Automotive Welding Metals and Plastics. Instructor's Guide																										X																											X	
Complete Automotive Welding Metals and Plastics. Text																										X																										X	
Complete Engine Performance and Diagnostic. Text													X	X		X	X	X																X	X																		
Complete Engine Performance and Diagnostics. Instructor'a Guide													X			X	X	X																X	X																		
Complete Under Car Systems - Steering and Suspension. Instructor's Guide							X												X		X			X	X																			X			X						
Complete Under Car Systems - Steering and Suspension. Shop Manual							X												X		X			X	X																			X			X						

Mechanics Resources

THEME CODE:
A. Vehicle Design & Ownership
B. Energy & Propulsion Systems
C. Control & Transmission Systems
D. Material & Structural Systems
E. Project & Service Work

FORMAT CODE:
P - Print
V - Video
S - Software

STATUS CODE:
B - Basic
S - Support
T - Teaching

LEVEL CODE:
1 - Introductory
2 - Intermediate
3 - Advanced

| EQUIPMENT | Format | Status | Junior/Senior High | Modes & Mechanisms | Vehicle Care | Engine Fundamentals | Electrical Fundamentals | Pneumatic & Hydraulic Systems | Mechanical Systems | Ride & Control Systms | Vehicle Structures & Materials | Metal Forming and Finishing | Surface Preparation I | Vehicle Detailing | Vehicle Maintenance | Lubrication & Cooling System | Fuel & Exhaust Systems | Alternate Fuel Engines | Ignition Systems | Emission Controls | Electrical Components | Power Assist Accessories | Braking Systems | Hydraulic Accessories | Power Trains | Manual Transmissions | Suspension Systems | Steering Systems | Metal Repair & Finishing | Trim Removal & Installation | Surface Preparation II | Refinishing I | Basic Touch-up & Finishing | Interior Finishes and Repairs | Buying & Selling a Vehicle | Vehicle Value Appraisal | Engine Performance Diagnosis | Engine Tune-up | Engine Removal & Installation | Engine Reconditioning I | Engine Reconditioning II | Alternate Propulsion Systems | Computer Managment Systems | Safety Systems | Climate Control | Power Assisting | Automatic Transmissions | Power Train Repair | Wheel Alignment | Body Repair Estimation | Structural Damage Analysis | Structural Damage Repair I | Structural Damage Repair II | Refinishing II | Plastic & Fiberglass | Glass Removal & Installation |
|---|---|---

Mechanics Resources

THEME CODE:
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STATUS CODE:
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EQUIPMENT	Format	Status	Junior/Senior High
LEVEL			
THEME			
SPECIAL FACILITIES			
			101 Modes & Mechanisms
			102 Vehicle Care
Small Gas Engines. Text	P	S	J/S
Small Gas Engines. Workbook	P	S	J/S
Today's Technician: A Manual Transmissions and Transaxles. Shop Manual	P	T	S
Today's Technician: Manual Transmissions and Transaxles. Classroom Manual	P	T	S

LEVEL	THEME	SPECIAL FACILITIES		Small Gas Engines. Text	Small Gas Engines. Workbook	Today's Technician: A Manual Transmissions and Transaxles. Shop Manual	Today's Technician: Manual Transmissions and Transaxles. Classroom Manual
			101 Modes & Mechanisms				
1	A	•	102 Vehicle Care				
1	B	•	104 Engine Fundamentals	X	X		
1	C	•	109 Electrical Fundamentals				
1	C	•	111 Pneumatic & Hydraulic Systems				
1	C	•	113 Mechanical Systems			X	X
1	D	•	115 Ride & Control Systms				
1	D	•	116 Vehicle Structures & Materials				
1	D	•	117 Metal Forming and Finishing				
1	D	•	119 Surface Preparation I				
2	A	•	201 Vehicle Detailing				
2	A	•	202 Vehicle Maintenance				
2	B	•	203 Lubrication & Cooling System	X	X		
2	B	•	204 Fuel & Exhaust Systems	X	X		
2	B	•	205 Alternate Fuel Engines				
2	B	•	206 Ignition Systems	X	X		
2	B	•	207 Emission Controls				
2	C	•	209 Electrical Components				
2	C	•	210 Power Assist Accessories				
2	C	•	211 Braking Systems				
2	C	•	212 Hydraulic Accessories				
2	C	•	213 Power Trains			X	X
2	C	•	214 Manual Transmissions			X	X
2	D	•	215 Suspension Systems				
2	D	•	216 Steering Systems				
2	D	•	217 Metal Repair & Finishing				
2	D	•	218 Trim Removal & Installation				
2	D	•	219 Surface Preparation II				
2	D	•	220 Refinishing I				
2	D	•	221 Basic Touch-up & Finishing				
2	D	•	222 Interior Finishes and Repairs				
3	A	•	301 Buying & Selling a Vehicle				
3	A	•	302 Vehicle Value Appraisal				
3	B	•	303 Engine Performance Diagnosis				
3	B	•	304 Engine Tune-up				
3	B	•	305 Engine Removal & Installation				
3	B	•	306 Engine Reconditioning I				
3	B	•	307 Engine Reconditioning II				
3	B	•	308 Alternate Propulsion Systems				
3	C	•	309 Computer Managment Systems				
3	C	•	310 Safety Systems				
3	C	•	311 Climate Control				
3	C	•	312 Power Assisting				
3	C	•	313 Automatic Transmissions				
3	C	•	314 Power Train Repair			X	X
3	D	•	315 Wheel Alignment				
3	D	•	316 Body Repair Estimation				
3	D	•	317 Structural Damage Analysis				
3	D	•	318 Structural Damage Repair I				
3	D	•	319 Structural Damage Repair II				
3	D	•	320 Refinishing II				
3	D	•	321 Plastic & Fibreglass				
3	D	•	322 Glass Removal & Installation				

OTHER RESOURCES

These titles are provided as a service only to assist local jurisdictions to identify resources that contain potentially useful ideas for teachers. Alberta Education has done a preliminary review of the resources. However, the responsibility to evaluate these resources prior to selection rests with the user, in accordance with any existing local policy.

Distributor Code	Other Resources
AECD	*Apprenticeship Training: Agriculture Mechanic Program*. Edmonton, AB: Alberta Advanced Education and Career Development, Apprenticeship and Industry Training. Curriculum outline. Describes the parameters/course requirements for apprenticeship in the Agriculture Mechanic trade.
AECD	*Apprenticeship Training: Auto Body Technician Program*. Edmonton, AB: Alberta Advanced Education and Career Development, Apprenticeship and Industry Training. Curriculum outline. Describes the parameters/course requirements for apprenticeship in the Auto Body Technician trade.
AECD	*Apprenticeship Training: Automotive Service Technician Program*. Edmonton, AB: Alberta Advanced Education and Career Development, Apprenticeship and Industry Training. Curriculum outline. Describes the parameters/course requirements for apprenticeship in the Automotive Service Technician trade.
AECD	*Apprenticeship Training: Heavy Duty Technician Program*. Edmonton, AB: Alberta Advanced Education and Career Development, Apprenticeship and Industry Training. Curriculum outline. Describes the parameters/course requirements for apprenticeship in the Heavy Duty Technician trade.
AECD	*Apprenticeship Training: Motorcycle Mechanic Program*. Edmonton, AB: Alberta Advanced Education and Career Development, Apprenticeship and Industry Training. Curriculum outline. Describes the parameters/course requirements for apprenticeship in the Motorcycle Mechanic trade.
ACC	*Car Owner's Maintenance Guide, A*. Edmonton, AB: ACCESS Network. Print.
PAB	*Highway Traffic Act*. Edmonton, AB: Queen's Printer. Includes Inspection of Write-off Vehicles.

Other Resources (Cont'd.)

Distributor Code	Other Resources
ACC	How the Motor Car Works (series). Edmonton, AB: ACCESS Network. Video. • *The Engine* • *Engine Lubrication* • *The Carburator.*
PAB	*Motor Transportation Act.* Edmonton, AB: Queen's Printer. Includes Public Vehicles, general equipment and safety regulations. Commercial Vehicle Maintenance Standards.
PAB	*Occupational Heath and Safety Act.* Edmonton, AB: Queen's Printer. Provides current information on health and safety as it pertains to the workplace.

ADDITIONAL SOURCES

Available to Mechanics teachers, both locally and provincially, are many sources that can be used to enhance the Mechanics strand. These sources are available through the community, government agencies, resource centres and organizations such as motor vehicle manufacturers and equipment manufacturers that have user manuals that contain valuable information for Mechanics programs. Some of these sources, e.g., government departments, undergo frequent name and/or telephone number changes. Please check your telephone directory or an appropriate government directory.

The following is a partial list of sources to consider.

TEACHER-LIBRARIANS

Planned and purposeful use of library resources helps students grow in their ability to gather, process and share information. Research activities require access to an adequate quantity and variety of appropriate, up-to-date print and non-print resources from the school library, other libraries, the community and additional sources. Some techniques to consider are:

- planning together
- establishing specific objectives
- integrating research skills into planning.

Cooperation between the teacher-librarian and the subject area teacher in the development of effectively planned resource-based research activities ensures that students are taught the research skills as well as the subject content.

Also see *Focus on Research: A Guide to Developing Student's Research Skills* referenced in the Alberta Education Resources section.

ALBERTA EDUCATION SOURCES

The following monographs are available for purchase from:

Learning Resource Distributing Centre
12360 142 Street
Edmonton, AB
T5L 4X9
Telephone: 427-2767
Fax: 422-9750

Please consult the "Support Documents" section or the "Legal, Service and Information Publications" section in the *Buyers Guide* for ordering information and costs.

Developmental Framework Documents

- *The Emerging Student: Relationships Among the Cognitive, Social and Physical Domains of Development*, 1991

  This document looks at the whole child, or student, as a productive learner, integrating all the domains of development: cognitive, social and physical. It emphasizes the need for providing balanced curriculum and instruction.

- *Students' Interactions Developmental Framework: The Social Sphere*, 1988

  This document focuses on the student as a social being. It looks at the student's affective or emotional growth and examines moral development. These three domains make up the social sphere.

- *Students' Physical Growth: Developmental Framework Physical Dimension*, 1988

  This document examines children's normal physical growth in three areas: perceptual, structural and motor development. In none of these areas is the child's growth in a single continuous curve throughout the first two decades of life. Physical growth is characterized by periods of rapid growth and, periods of slower growth. Consequently differences and changes in growth patterns may affect the timing of certain learning processes.

- *Students' Thinking: Developmental Framework Cognitive Domain*, 1987

  This document explores children's cognitive development from infancy to adolescence. The Piagetian stages of pre-operational, concrete operational and formal operational thinking are explained. Suggestions for improving the learning process are also presented.

Others

- *Focus on Research: A Guide to Developing Students' Research Skills*, 1990

  This document outlines a resource-based research model that helps students manage information efficiently and effectively, and in this process, to gain skills that are transferable to all school and work situations. This model provides a developmental approach to teaching students how to do research.

- *Teaching Thinking: Enhancing Learning*, 1990

  Principles and guidelines for cultivating thinking, ECS to Grade 12, have been developed in this resource. It offers a definition of thinking, describes nine basic principles on which the suggested practices are based, and discusses possible procedures for implementation in schools and classrooms.

OTHER GOVERNMENT SOURCES

ACCESS Network

ACCESS Network offers a variety of resource and services to teachers. For a nominal dubbing and tape fee, teachers may have ACCESS Network audio and video library tapes copied.
ACCESS Network publishes a listing of audio and video cassettes as well as a comprehensive programming schedule.

Of particular interest are the Career and Technology Studies videos that are available with teacher utilization guides. The guides outline key points in each video and suggest questions for discussion, classroom projects and other activities. Video topics are listed in the Support Learning Resources section of this Guide. The videos and accompanying support material can be obtained from:
ACCESS Network
3720 76 Avenue
Edmonton, AB
T5B 2N6
Telephone: 440-7777 (in Edmonton)
1-800-352-8293
(outside Edmonton)

Alberta Advanced Education and Career Development

Library
Information and Policy Services
9th Floor Commerce Place
10155 102 Street
Edmonton, AB
T5J 4L5
Telephone: 422-4752
Fax: 427-0793
Career Information Catalogue Update, 1994
The Career Planner
Children Challenge Choice
Entrepreneur: A Big Word for Small Business
Rural Women as Business Entrepreneurs
Positive Works
Skills are your Passport.

Videos on career planning and entrepreneurial topics are available through the library of this department. Call 422-4752 for more information. The following videos are representative of the library's holdings:
The Entrepreneur
Get a Job
A Head for Business
The Seven Phases of a Job Interview.

Alberta Apprenticeship Program

For more information, contact the Alberta Advanced Education and Career Development office nearest you or call the Alberta Career Information Hotline, 1-800-661-3753 (toll-free), Edmonton 422-4266.

Alberta Economic Development and Tourism

Strategic Planning and Research
9th Floor, Sterling Place
9940 106 Street
Edmonton, AB
T5K 2P6
Telephone: 422-9494
Fax: 422-5922

Financing a Small Business
Marketing a Small Business
Starting a Small Business.

Alberta Environmental Protection
Education Branch
12th Floor, 9820 106 Street
Edmonton, AB
T5K 2J6
Telephone: 427-6310
Fax: 427-2512

(Workshops and presentations can be arranged.)

Alberta Environmental Protection
Land and Forest Services
9920 108 Street
10th Floor, Bramalea Building
Edmonton, AB
T5K 2M4
Telephone: 427-3551
Fax: 427-0292

Alberta Health
Environmental Health Services
10030 - 107 Street
Edmonton, AB
T5J 3E4
Telephone: 427-2643

Alberta Labour
9940 - 106 Street
Edmonton, AB
T5K 2N2
Telephone: 427-8848

Offices are also in Calgary, Camrose, Edson, Fort McMurray, Grande Prairie, Lethbridge, Medicine Hat, Red Deer and Vermillion.

Environment Canada
Inquiry Centre
10 Wellington Street, 1st Floor
Hull, Quebec
K1A 0H3
Telephone: (819) 997-2800
Fax: (613) 953-2225

Environmental Council of Alberta
400, 9925 109 Street
Edmonton, AB
T5K 2J8
Telephone: 427-5792
Fax: 427-0388

Industry and Science Canada
Consumer Affairs
10225 100 Avenue
Edmonton, AB
T5J 0A1
Telephone: 495-2485
Fax: 495-6451

or

301, 510 12 Avenue SW
Calgary, AB
T2R 0H3
Telephone: 292-5604
Fax: 292-6175

National Film Board of Canada (NFB)
The NFB has numerous films and videotapes that may be suitable for Mechanics. For a lising of NFB films and videotapes indexed by title, subject and director, or for rental or purchase of NFB films and videotapes, call 1-800-267-7710 (toll-free).

Educational Marketing Officers in Calgary and Edmonton are available, province wide, for workshops, conferences, professional development days and similar activities. For northern Alberta and the Northwest Territories, the Educational Marketing Officer can be reached at 495-3012 (fax, 4956412). For southern Alberta, contact the Educational Marketing Officer at 292-5411 (fax, 292-5458).

ACCESS Network and some school boards have acquired duplication rights to some NFB videotapes. Please consult the relevant catalogues in your school or school district.

The Calgary Public Library has a selection of NFB films and videotapes that can be borrowed free of charge with a Calgary Public Library borrower's card. For further information, contact:

Calgary Public Library
Films and Recordings Department
616 Macleod Trail SE
Calgary, AB
T2G 2M2
Telephone: 260-2781
Fax: 292-5458

Resource Centres

Urban Resource Centres

Calgary Board of Education
Supervisor, Education Media
3610 9 Street SE
Calgary, AB
T2G 3C5
Telephone: 294-8540
Fax: 287-9739

Calgary Separate School Board
Supervisor, Instructional Materials
6220 Lakeview Drive SW
Calgary, AB
T3E 5T1
Telephone: 246-6663
Fax: 249-3054

County of Strathcona
Director, Learning Resource Service
2001 Sherwood Drive
Sherwood Park, AB
T8A 3W7

Edmonton Public School Board
Learning Resource Consultant
Centre for Education
One Kingsway Avenue
Edmonton, AB
T5H 4G9
Telephone: 429-8320
Fax: 429-8318

Lakeland School District No. 5460
Area Superintendent
Postal Bag 1001
6005 50 Avenue
Bonnyville, AB
T9N 2L4
Telephone: 826-3145
Fax: 826-4600

Medicine Hat School District No. 76
IMC Manager
601 1 Avenue SW
Medicine Hat, AB
T1A 4Y7
Telephone: 526-1323
Fax: 529-5339

Red Deer Public School Board
Coordinator of Instruction
4747 53 Street
Red Deer, AB
T4N 2E6
Telephone: 343-1405
Fax: 347-8190

St. Anthony's Teacher Centre
Supervisor, Curricular Resources
10425 84 Avenue
Edmonton, AB
T6E 2H3
Telephone: 439-7356
Fax: 433-0181

Regional Resource Centres

Zone I

Zone I Regional Resource Centre
Film Supervisor
10020 101 Street
P.O. Box 6536
Peace River, AB
T8S 1S3
Telephone: 624-3187
Fax: 624-5941

Zone II and III

Central Alberta Media Services (CAMS)
Film Supervisor
182 Sioux Road
Sherwood Park, AB
T8A 3K5
Telephone: 464-5540
Fax: 467-5469

Zone IV

Alberta Central Regional Education Services (ACRES)
Operations Manager
Box 1000
Parkland Regional Library Building
5404 - 56 Avenue
Lacombe, AB
T0C 1S0
Telephone: 782-3850
Fax: 782-4650

Zone V

South Central Alberta Resource Centre
(SCARC)
c/o Golden Hills Regional Division
435 A Hwy #1
Strathmore, AB
T1P 1J4
Telephone: 934-5028
Fax: 934-5125

Zone VI

Southern Alberta Learning Resource Centre
(SALRC)
Film Supervisor
Provincial Government Administration Building
120, 909 Third Avenue North
Box 845
Lethbridge, AB
T1J 3Z8
Telephone: 320-7807
Fax: 320-7817

Statistics Canada
Regional Office
8th Floor, Park Square
10001 Bellamy Hill
Edmonton, AB
T5J 3B6
Telephone: 495-3023
Fax: 495-5318

PROFESSIONAL ASSOCIATIONS

Alberta Teachers' Association
Specialist Council
(Alberta Teachers' Association)
Barnett House
11010 142 Street
Edmonton, AB
T5N 2R1

INDUSTRY ORGANIZATIONS

Alberta Motor Association
10310 - 39A Avenue
Box 8180 St. South
Edmonton, AB
T6H 5X9
Telephone: (403) 430-5521

Alberta Special Waste Management Corp.
610, 10909 Jasper Avenue
Edmonton, AB
T5J 3L9
Telephone: 422-5029 or
1-800-272-8873
Fax: 428-9627

Motor Dealer Association of Alberta
9249 - 48 Street
Edmonton, AB
T6B 2R9
Telephone: (403) 468-9552

MOTOR VEHICLE MANUFACTURERS REGIONAL OFFICES

Chrysler Canada Limited
200, 10201 Southport Road SW
Calgary, AB
T2W 4X9
Telephone: 299-2900

Ford Motor Company of Canada Limited
11604 - 181 Street
Edmonton, AB
Telephone: 454-9621

General Motors of Canada
4220 Blackfoot Trail SE
Calgary, AB
Telephone: 531-5500

Honda Canada Inc.
13240 Worster Court
Richmond, BC
V6V 2B8
Telephone: (604) 278-7121

Mazda Canada Inc.
400, 2075 Kennedy Road
Scarborough, ON
M1T 3V3
Telephone: 1-800-263-4680

Nissan Canada Inc
Box 2501
New Westminster, BC
V3L 5A1
Telephone: (604) 526-4581

Toyota Canada Incl
5330 Skyline Way NE
Calgary, AB
T2E 6V1
Telephone: 295-1055

ENVIRONMENTAL FACILITIES

The following is a partial list of facilities that provide hands-on experience for students in aspects of resource management and environmental education. Contact should be made directly with the facility to obtain details of what is offered to school groups or students.

Energeum
(Energy Resources Conservation Board)
640 5 Avenue SW
Calgary, AB
T2P 3G4
Telephone: 297-4293

Environmental Resource Centre
10511 Saskatchewan Drive
Edmonton, AB
T6E 4S1
Telephone: 433-4808

OTHER AGENCIES

Canadian Foundation for Economic Education
501, 2 St. Clair Avenue West
Toronto, ON
M4V 1L5
Telephone: (416) 968-2236
Fax: (416) 968-0488

Entrepreneurship: A Primer for Canadians (teacher resource)
Labour Market: Teacher's Resource Package (teacher resource)
Money and Youth
Women in the Work Force.

The Conference Board of Canada
255 Smyth Road
Ottawa, ON
K1H 8M7
Telephone: (613) 526-3280
Fax: (613) 526-4857

Economic Forecast: Provincial Outlook (research reports, personalized information services).

FEESA
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CAREER & TECHNOLOGY STUDIES

MECHANICS

SAMPLE STUDENT LEARNING GUIDES

INTERIM 1995
(SEPTEMBER 1995 - SEPTEMBER 1997)

Modes and Mechanisms (MEC101) J.1
Vehicle Detailing (MEC201).....J. 5

Alberta
EDUCATION

MAY 1995

CURRICULUM STANDARDS BRANCH

WHY TAKE THIS MODULE?

- ☑ to learn and apply the design process
- ☑ to be creative and build a model of a transport vehicle
- ☑ to apply marketing and advertising skills during your sales campaign
- ☑ to learn about aerodynamics in all types of vehicles
- ☑ to test and evaluate your vehicle
- ☑ to use and compile a portfolio

WHAT DO YOU NEED TO KNOW BEFORE YOU START?

No previous experience is required for this module but understanding the design process is an asset.

To be successful you must be able to:
- follow safe lab procedures and safety regulations
- work cooperatively with others.

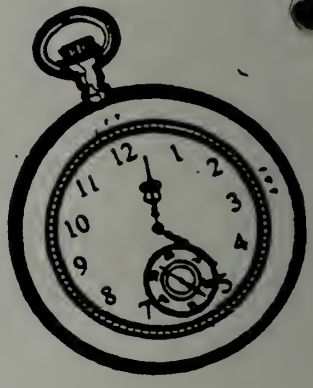
WHAT WILL YOU KNOW AND BE ABLE TO DO WHEN YOU FINISH?

On completion of this unit you should be able to:

- ☑ use basic hand and power tools in a safe manner
- ☑ sketch and use conventional drafting equipment or a CAD program
- ☑ use the design process to construct and create projects
- ☑ apply the laws of motion
- ☑ calculate and compare the performance of a vehicle
- ☑ evaluate your project

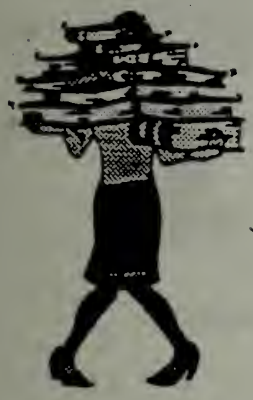
WHEN SHOULD YOUR WORK BE DONE?

You will have 25 hours to complete this unit. Approximately 8 hours of that time may be spent on demonstrations, lectures and the safe operation of tools and machines,



HOW WILL YOUR MARK FOR THIS MODULE BE DETERMINED?

	PERCENTAGE
☑ Research of a particular vehicle	10%
☑ Sketches and working drawing	20%
☑ Advertising campaign posters	10%
☑ Vehicle construction and performance	40%
☑ Safe use of tools and machines	10%
☑ Evaluation (self & teacher)	10%



WHICH RESOURCES MAY YOU USE?

- ☑ Technology Learning Wheel (1) Aerodynamics (2) Solar (3) Wind (4) Aerospace (5) Mag. Lev.
- ☑ Hacker, *Living with Technology*
- ☑ Browning, *Design and Technology*
- ☑ Gradwell, *Technology Shaping Our World*
- ☑ Science Directions 7 (Unit 3) 8 (Unit 2) & 9 (Unit 4)

ACTIVITIES/WORKSHEETS

STATEMENT OF A PROBLEM: Following the Design/Problem-Solving Process you will design and construct a model of a transportation vehicle using a simple power source, common materials and tools.

You will show marketing skills by designing a poster that promotes your vehicle.

RESEARCH: Using your science textbooks and the references provided, complete the following in your portfolio:

1. Describe the forces that are to be overcome when a vehicle moves:
   - on land
   - in water
   - in air
   - in space.

2. Determine what techniques can be used to:
   - start and stop a vehicle
   - speed up and slow down a vehicle
   - control the direction of a vehicle
   - give a vehicle stability.

3. Demonstrate and/or describe how energy can be used to produce motion in a:
   - spring
   - elastic
   - CO_2 capsule
   - electro-magnetic device.

ALTERNATIVE SOLUTIONS: Brainstorm and sketch three thumbnail drawings of your transportation vehicle and place into your portfolio.
Note: Remember your vehicle could be a land, air or water vehicle.

FINAL SOLUTION: Use drawing instruments to produce an orthographic drawing that shows the top and side of your concept vehicle. Place this drawing in your portfolio.

CONSTRUCTION: Choose the appropriate materials to construct a prototype by considering their:
   - workability
   - strength
   - weight
   - cost.

Safely construct the vehicle according to the specifications and working drawings.
Apply a finish to the vehicle to:
   - enhance its appearance
   - increase its performance
   - increase its longevity.

EVALUATION: Test the vehicle individually or in competition with others in relation to:
   - its speed in metres per second
   (Speed = $\frac{\text{Distance}}{\text{Time}}$)
   - load in grams.

PRESENTATION: During construction there may be some down time owing to the absence of machinery. You may design your advertising and marketing poster, which will be used for the final presentation of your transportation vehicle. The poster will be designed by you but it must include the following information:

1. The name of your vehicle

2. A colour drawing of the vehicle

3. Promotional information and any relevant data.

BE CREATIVE

WHY TAKE THIS MODULE?

- ☑ Today's modern vehicles reflect the many different attitudes and values of their owners. Through colour and graphic enhancement owners are able to express their personal satisfaction and pride in their vehicle. In this module, you will experience and become knowledgeable in the methods used to enhance exterior surfaces and engine compartments.

WHAT DO YOU NEED TO KNOW BEFORE YOU START?

- ☑ No previous experience is required for this module.
- ☑ Use basic hand tools and power drills in a safe manner
- ☑ Follow instructions as given by product manufacturers
- ☑ Work patiently and use time effectively.

WHAT WILL YOU KNOW AND BE ABLE TO DO WHEN YOU FINISH?

- ☑ List hazardous cleaning products and precautions for their use
- ☑ Describe several methods of altering and enhancing exterior appearances and identify correct methods used for each
- ☑ Demonstrate the correct methods for applying waxes, cleaners and trim paints
- ☑ Identify common trim fasteners and the procedures for removal and installation of trim
- ☑ Successfully apply pin striping and/or decals to a vehicle
- ☑ Show knowledge of the value of vehicle enhancement and possible career opportunities.

WHEN SHOULD YOUR WORK BE DONE?

HOW WILL YOUR MARK FOR THIS MODULE BE DETERMINED?

	PERCENTAGE
☑ Safe use of materials and tools	10%
☑ Identification of products best suited for the work to be done	10%
☑ Knowledge of trim options and methods of application and fastening	10%
☑ Project completion: exterior clean and wax, trim repair, installation, engine beautification.	70%

WHICH RESOURCES MAY YOU USE?

- ☑ Basic set of hand tools, hand drill and bits and specialty trim removal tools as required
- ☑ Trim products: pin striping, decals, molding, spray paint and any student-purchased accessory to be installed
- ☑ Assortment of degreasers, cleaners, waxes and related application products and tools
- ☑ Engine spray paint and miscellaneous hardware (as required).

ACTIVITIES/WORKSHEETS

Activity 1

Challenge: Identify painted and trim surface flaws and follow methods described by product manufacturer to correct and enhance the appearance using degreasers, waxes and possibly trim paint.

Limitations: Vehicles must be in reasonably good shape, where products used will be effective in meeting the expectations.

Expectations:

- A complete vehicle cleaning, using suitable products and procedures. This is to be followed by minor surface flaw corrections, e.g., light sanding or touch-up with spot paint.
- Wax and polish surfaces using methods described by product manufacturers. Include chrome, rubber, vinyl and other trim.
- Glass cleaning using appropriate product.

Resources: Catalogues from local auto supply stores, e.g., Canadian Tire, UAP
Service/product manual from Meguiars product line.

Activity 2

Challenge: Remove and/or replace trim parts using appropriate tools and methods. This may include installation of a new trim part and an examination of 3 or 4 methods of fastening trim (e.g., clips, 2-way tape, blind nuts, etc.).

Limitations: Vehicle type or budget in the case of new trim parts.

Expectations:

- Use appropriate tools to remove window and side trim as applicable and replace.
- Install an accessory trim part such as side molding, mud flaps, running boards or other as desired.
- Apply pin striping and/or decaling to enhance the appearance of the vehicle. Repeat.

Resources:

- Auto supply dealers and supply catalogs
- *Autobody Repair and Refinishing*, Hogg (1988) Fasteners
- Product installation manuals when available.

Activity 3

Challenge: To clean and paint, for visual enhancement, the engine compartment of a vehicle.

Limitations: Vehicle should be in need of work where the end product is indeed enhancing and visually rewarding.

Expectations:

- Safely use degreaser and cleaners to clean the engine compartment, avoiding damage to electrical and other related systems.
- Follow safety instructions provided in repainting of the engine and adjacent surfaces to produce a like-new appearance, and generally clean-up the area by grouping or realigning wires and hoses.
- Service the hinges, latch and hood anti-vibration bumpers.
- Optional: Install owner-purchased accessories used for visual enhancement, e.g., chrome or wire/hose coverings.
- Service battery terminals and battery.

Resources:

- Auto service manual, engine cleaning
- Peterson publication(s) Engine Beautification

Other Suggested Activities

1. Visit two local ~~auto~~ accessory stores to examine the cost of parts desired and their availability.
2. Visit a local auto dismantler to examine variations in trim, design and fastening. Also examine the value in used parts that are available. Remove and purchase desired trim or parts required for a repair.
3. Career exploration: Visit a professional trim application service centre or arrange for a professional trim applicator to visit the class.

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The **Career and Technology Studies Advisory Committee** provides recommendations for all CTS curricula. Membership on the committee has changed over time; below is a complete list of members.

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1993-94 Field Review

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1994-95 Field Review

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